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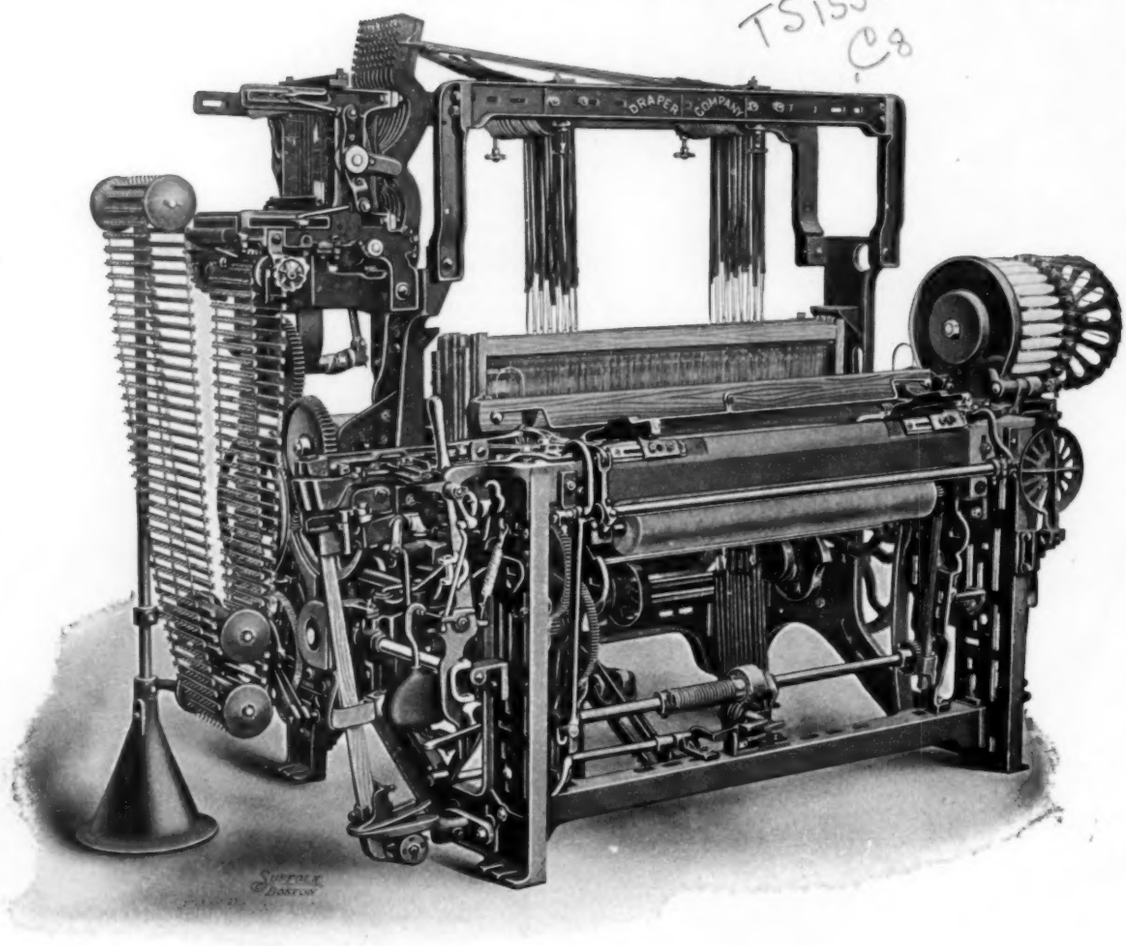

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Vol. 75, No. 1. ATLANTA, GA., NOVEMBER, 1910.

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THE HOME MARKETS FOR FINE FABRICS.

Personal interviews with upward of two hundred New York agents for the wholesalers and retailers of the Middle, Western and Eastern States, give the firm foundation for the statement that the principal domestic markets for fine fabrics of cotton are; as to the West highly active, and as to the Middle and Eastern States, well up to an average, that is, almost 90 per cent. of the highest degree of consumptive demands ever recorded in October. Much that is passing current for information in the textile consuming lines is merely matter that is written to order for the purpose of having effect upon political and financial manipulations that are engineered for the profit of syndicates of stock market riggers and political machine operators. A good deal of this matter is put forth in sensational newspapers and in trade papers of low grade that probably find some pecuniary account in publishing such misinformation.

Cotton finds among real business men who are doing real business in all grades of cotton products a well nigh unanimous feeling that the last quarter of the year will make a good showing for distributors and retailers. Basic prosperity is grounded upon our agriculture, manufactures and mineral output. For this year those industries will have the aggregate value, at sources of origin, of 21 billions of dollars. Our whole volume of commerce is now moving at the volume of 27 billions of dollars, which overtops the high boom year of 1907. The net profits from all the undertakings of the people of our country for the current year will be five and one-half billion dollars—which is almost the double of the total possessions of all kinds of money to the credit of all our people.

The supreme confidence of the best informed men in the cotton goods trade rests upon these remarkably strong basic conditions. They who look through the commercial and financial situations through blue spectacles in all our markets are neither well informed merchants nor manufacturers; they are merely men whose income from stock market manipulation comes from utilizing pessimistic statements as capital for ulterior ends. Privately, these market riggers say that the nation was never in better shape to the liking of conservative business men. Great retailers tell us that in certain lines of fancy cottons the difficulty is to get requisite quantities for pressing demands. Long over due deliveries are not found fault with today as to certain lines, which under other conditions as to the retail demands would have brought about cancellations of orders.

In hosiery and underwear the retail markets are remarkably good in medium and high grade wares. Hand to mouth buying in all grades of cotton goods has ruled so long that notwithstanding the insistent demands from the big retail houses for quick shipments by distributors, the shelves of the retailers are poorly stocked, and in some fast

selling wares, the retailers are all sold out, and are employing every method for prodding up the distributors.

WORDS AND WORK.

In a future history of American progress the present era will rank as a time of practical attainment, of scientific discoveries and of mechanical inventions and appliances which contribute largely to man's comfort and happiness and which even aid his mental and moral advancement. But the psychologist of the future should consider one striking characteristic of the present which the historian may overlook and yet which plainly distinguishes this era from any that has preceded it in the whole history of civilization. Like all momentous influences this one is a slow evolution rather than a sudden achievement, for we refer to the gradual growth of that passion for verbal expression which has taken possession of all classes, beginning with the immature girl and boy in the school room and ranging from the mechanical worker, the social leader, the master of high finance, the politician, until it reaches the trained writer the tools of whose trade are verbal ones and whose clever juggling with elusive and appropriate words is a life-long profession.

This growing tendency toward written and spoken expressions which freely give to an ever eager public personal experiences in the most minute and intimate details, may be said to mark the difference, too, between the genuine activities of the present and the artificial atmosphere of a past, which warranted that epigrammatic French scholar and courtier, Tallyrand, in declaring that "language was given us to conceal our thoughts." Today language seems given us not only to reveal our thoughts but to invest them with renewed force and even with increased practical usefulness. That this is true may be taken as an evidence of the steady growth of the individualism of the American workman, for despite all that has been chargd as to the suppression of the individual by the necessary combination of workmen which form the present day corporation, and which conditions now demand, it is obviously true that no amount of corporate organization can possibly suppress or ignore the great vital force generated by strong individual characteristics. Such a force naturally seeks expression, as was recently most strikingly shown by a letter received by COTTON from an overseer in a prominent cotton mill. This letter was but one of many which have come, from time to time, from workmen in every part of the country, but it was a distinctive communication inasmuch as the writer stated, as a sort of prelude, that he had been brought up on a farm until he was twenty-one years old; that he had had but little education and was "no writer," but, at the same time, he was often helped by the ideas of his fellow workmen, and he hoped some of them might be helped by his ideas, also. "And," he continued, "it helps me, myself, to put my thoughts and experiences in words; for by so doing I seem to get them in better shape to hold to."

There is a whole volume of philosophy in that letter, for even though the author of it is, as he said, "no writer," yet he is something much more useful in the scheme of things—he is a worker and a thinker; a man whose work in a cotton mill is to him so much of a vocation, a high calling, that it carries with it a message which he is forced to utter.

It has been always thus with the great men who have labored in the field of practical endeavor; Sir Isaac Newton, Galileo, our own Ben Franklin, and myriads of others have all been forced to tell about their work, thus greatly increasing the usefulness of their discoveries or inventions.

It is highly significant, therefore, of the present status of our industrial arts when those who cultivate them are seemingly forced from work to words in order to share their secrets and their interests with others of their craft, and who, at the same time, recognize the value to themselves of this impulse toward descriptive expression. This, too, may be said to be the underlying principle of all trade publications, for each one which fulfills its mission does so by expressing the spirit of the industry it represents in order that there may be felt a sort of *esprit de corps* among all those engaged in the same craft. When workers in the humbler ranks of industrial life also recognize this impelling force then, indeed, we may discern the dawning of a yet brighter era for the man who works with his hands because he has formed a partnership with his head as well.

With the calm, progressive atmosphere of our own country at this time the workman who thinks, and who couples a trained body with a trained mind, will soon find himself carried along the broad highway toward successful attainment, while at the same time he is well armed, in advance, to meet and to resist any dangers, doubts or difficulties which even the most turbulent or complex industrial or social conditions could create.

SOUTHERN TEXTILE ASSOCIATION TO MEET.

The Southern Textile Association will hold its Fall meeting on Saturday, November 26th, in Charlotte, N. C., this being in accordance with the resolution adopted at the last meeting of the Association held in Augusta, Ga., to hold two meetings a year instead of three; one on the Saturday nearest to Thanksgiving day, and the other on the Saturday closest to July 4th. Various committees have been appointed in Charlotte to make preparations for the forthcoming meeting. The committee on arrangements consists of J. H. Bagwell, H. W. Warner, J. C. Buice, J. W. Fox and W. H. Hearne. An outline of the arrangements for the day includes a first session at eleven o'clock in the morning, at which there will be an address of welcome and response, followed by the President's address, and several papers dealing with practical subjects connected with mill work. The afternoon session will begin at 2:30, when other papers will be read and discussed. The evening session will be devoted largely to social entertainment, thus rounding out a full day for the Association.

The officers of the Association, elected at the last meeting are: W. P. Hamrick, Supt. Olympia Cotton Mills, Columbia, S. C., Pres.; Arthur T. Smith, Supt. Langley (S. C.) Mfg. Co., Vice-Pres.; E. E. Bowen, Overseer of Weaving, Great Falls Mfg. Co., Rockingham, N. C., second Vice-Pres.; E. M. McEntire, Supt. Loray Mills, Gastonia, N. C., third Vice-Pres.; M. E. Stevens, Supt. Columbus Mfg. Co., Columbus, Ga., fourth Vice-Pres.; G. S. Escott, Editor Mill News, Charlotte, N. C., Secy.; David Clark, editor Textile Manufacturer, Charlotte, N. C., Treas. There are nearly 600 members enrolled and it is expected that there will be a very large attendance at the forthcoming meeting.

The New Maverick Mills at East Boston.

(Contributed exclusively to COTTON.)

BY H. M. WILCOX.

THIS MILL MARKS A NEW ERA IN MILL CONSTRUCTION—REINFORCED CONCRETE USED.

In spite of the undoubted superiority of reinforced concrete as a type of construction, cotton manufacturers have been rather more conservative than most others in its adoption. This can probably be accounted for by the fact that the numerous problems peculiar to the manufacture of cotton, which must be solved in adopting concrete, have made most owners somewhat chary about making the change from the already fairly satisfactory slow burning mill construction type of building.

The directors of the new Maverick Cotton Mills in East Boston, Mass., which have just been completed and are just about to start up, took a decided step in advance when they decided to erect their plant entirely of reinforced concrete. This course was suggested by Lockwood, Greene and Co. of Boston, who had charge of the work. There were a great many problems to be solved in connection with the installation of the textile machinery and the power transmission equipment, but every one of these has been met and solved in a most satisfactory manner. One of the greatest factors in favor of reinforced concrete for cotton mill construction is the almost entire absence of vibration, usual in mills built of the old style brick and heavy timber construction. It is anticipated that on account of this absence of vibration, the wear and tear on the textile machinery will be much lessened, thus effecting a very considerable saving in cost of upkeep and in depreciation of same. The factors of safety from fire, non-depreciation, cleanliness, and the fact that the buildings are practically monolithic further influenced the directors to adopt this type of construction.

The present buildings consist of the main mill 550 ft. long by 130 ft. wide, two stories high, with 16 ft. clear from floor to floor; a weave shed 340 ft. by 231 ft., one story with saw-tooth roof; one end of the main mill joins the weave shed. The power house is 91 x 62 ft. and adjoins the corner of the weave shed next to the main mill. There is also a small detached office building, 30 x 40 ft., two stories in height.

The actual design of the concrete building contains a number of very interesting features, among which may be counted the heavy girders which support the exterior walls. The problem presented here is that of taking the concentrated load of the columns and transmitting it into uniformly distributed load over the piles which form the foundation. This was accomplished by designing these girders somewhat as ordinary concrete girders uniformly loaded and supported at fixed points, and then placing them upside down. The concrete saw-tooth girders were designed with sufficient stiffness so that no horizontal tie rods from bay to bay were necessary. This gives a clear sweep the entire length of each bay and in the absence of any overhead shafting makes a very light and handsome weave shed.

The spinning mill is equipped with Howard and Bullough machinery throughout, except the warpers which are made by the T. C. Entwistle Co., and the spoolers which were made by Easton & Burnham. There is being installed at the present time a total of 51,200 spindles, with room for 10,240 more in the present buildings. In the weave shed there are 995 40-inch Stafford looms with room for 240 more to be installed later. The cloth room and repair shop are located in one side of the weave shed next to the main mill.

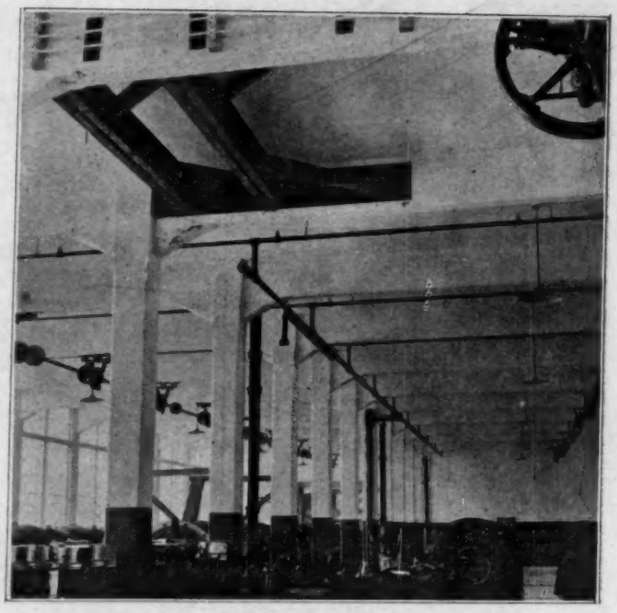
MAVERICK MILLS, EAST BOSTON, MASS. POWER HOUSE ON THE LEFT.

The engineers, Lockwood, Greene and Co., were confronted with a number of new and interesting problems in connection with the installtaion of the textile machinery and the power transmission equipment. In regard to the former it was found that on account of the increased frictional resistance between the concrete floors and the base of the machines that on a large part of the lighter running machinery two or three expansion bolts placed in holes drilled in the concrete floor were all that were necessary. As an example of the saving in labor which was effected in attaching machines on the spinning frames where in a wooden and brick mill 22 lag screws would be required to attach a frame to the floor it was only necessary in this mill to use six, two at the head, two at the tail, and one at either side about one-third from each end. In placing the drawing frame can tables, which are usually set down into the maple flooring, in this building they were placed

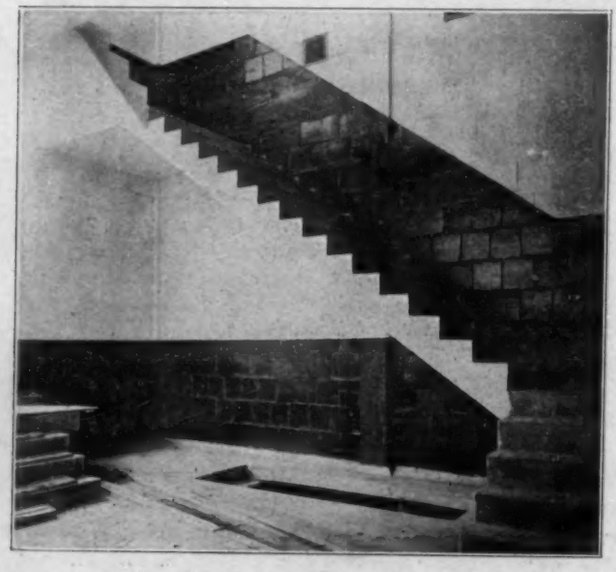
on the finished granolitihc floor and firmly grouted down, the drawing frames being raised a similar distance above the floor. The fan casing on the pickers caused a little trouble, but was finally secured by using angle cleats and small expansion bolts driven into the concrete floor. An air drill was used for driving the holes in the concrete which did not entail much more labor than boring holes for lag screws in a wooden floor.

The entire mill is driven by electric power, the motors being suspended from the ceiling by especially designed frames with the exception of four 100-horsepower floor motors located in the basement of the weave shed which drive the looms. In regard to the latter, each motor drives five lines of shafting which extend the entire width of the weave shed. The looms are driven direct from this shafting by belts passing through holes left in the concrete floor. The proper arrangement of the floor reinforcement so as not to weaken the floor and not interfere with the locating of the belt holes required very careful designing on the part of the engineers. The weave shed shafting is supported by ordinary wall hangers bolted to the concrete columns. Vertical strips of wood five inches high by one inch thick and extending entirely through the columns were embedded in the concrete at the point where the shaft hangers were to be attached. Holes were bored through these strips and the shaft hangers bolted directly to the column.

In the spinning mill where the motors were suspended from the ceiling horizontal bolt holes were left in the girders at points where the motors were to be attached. Wrought iron plates were securely bolted at either side of the concrete girders and to these plates were riveted angles to which channels were attached extending from girder to girder. The motors were then slung by heavy bolts from these channels. For the larger motors angle braces were used to stiffen the framework. An interesting method was developed for driving the spinning frames. Each motor in the spinning room was equipped with a double pulley on each end of the armature shaft. In place of a flange to separate the belts, the crowning of each section of the double pulley was made one-quarter of an inch off center away from the middle of the pulley. By this means, the belts can be kept apart without any danger of their climbing a flange and being thrown off. Furthermore, the belts can be shifted from the tight to the loose pulley on the spinning frame without being thrown off the motor pulley. All the shafting and the motor supports were supplied by the Jones & Laughlin Steel Co., Pittsburg, Pa. The Otis Elevator Co. furnished and installed the elevators in the main mill.



VIEW SHOWING CONCRETE CONSTRUCTION AND MOTOR SUPPORT.



CONCRETE STAIR TOWER IN MAVERICK MILLS.

The power plant equipment consists of three 400-horsepower Edgemoor water tube boilers built for 180 pounds working pressure, each boiler being equipped with a Foster superheater capable of producing 100 degrees of superheat. The boilers are equipped with a Sturtevant economizer and an induced draft installation. The B. F. Sturtevant Co., Hyde Park, Mass., also installed the indirect heating system which is distributed through the main mill by outside pilasters located on the north side of the building and through the weave shed by hot air risers. The main power generating set consists of a 1,500-kilowatt Allis-Chalmers turbo alternator exhausting into a Wheeler surface condenser. This operates at 800 r. p. m. and is guaranteed to show 1,500 kilowatt with an indicated steam pressure of 175 pounds and 28 inches vacuum. It furnishes 3-phase, 60-cycle current at 300 volts. The Allis-Chalmers Co. furnished the above generator set together with one steam driven exciter set and one motor driven exciter set and the switchboard, all of which are located in the engine room. The steam supply for the turbine is furnished by a six-inch line from the steam main in the boiler room through a separator designed by Lockwood, Greene and Co. The condenser is equipped with a centrifugal circulating pump with a 14-inch suction and 12-inch discharge and with a Pratt rotrex pump with a 10-inch connection from the condenser and an 8-inch discharge. This condenser is manufactured by the C. H. Wheeler Mfg. Co., Philadelphia, Pa. The two boiler feed pumps are of the Sturtevant duplex outside packed plunger type 10 x 6 x 12 inch. The boiler feed pumps force the water through a Wheeler feed water heater which utilizes the exhaust steam from the various auxiliary engines.

EXPORT TRADE IN LINTERS TO GERMANY.

(Contributed exclusively to COTTON.)

BY ROBERT HECHT, GRADUATE OF THE EXPORT ACADEMY, VIENNA, EXPORT MANAGER, ADLER-MAY COTTON PRODUCTS CO., ATLANTA, GA.

There is no doubt that Germany uses a good part of our output in linters, but as true as this fact is, it is very much to be regretted that the way in which this business is carried on between our exporters and the German parties is mostly unsatisfactory for both sides. In some cases it is only a few seasons—mostly one—that concerns continue trading relations and in general these parties dissolve their trade relations with losses for one concern or even for both. It is a peculiar fact, but nevertheless true, that the opinion in Germany is that those American shippers are seeking their chances in a bad way. In the same way the American shippers here think that the business is never handled straight by those German concerns. At the beginning it will be well to remark that we are to consider only the direct trade between the American linter exporters with Germany, and not the trade of those German firms which have their offices here and who buy and pay here, as this business is handled on quite another basis. The question under present consideration is what are the difficulties in this trade and what can be done from both sides to facilitate it?

The first thing is that this business is seldom in the hands of responsible people who are financially strong enough to handle the business properly, and when starting the trade they do not correctly figure how such transactions will develop. The payment is usually done by draft on prime London or German bankers against exchange of documents at 60d/s, 90d/s sight—seldom cash against documents—drawing on the full amount or a certain percentage ranging from 75 per cent. to 90 per cent. To the latter remark we will come back later on. An important difficulty is that the drafts have in general to be accompanied by the port bill of lading or even the railroad bill of lading with the master receipt. Those German banks who are interested in the linters trade are not to blame when they force their customers to accept only such a term as before mentioned. By such precautions they can see more chance of real dealing; besides it might happen sometimes that the drafts are accepted and paid before the shipment arrives in the German port. In order not to tie up the money of our shipper for too long a time, the American bankers who are interested in the linters trade should advance a certain percentage on those export lots which are shipped by railroad to the port, if their customer can prove that the goods are sold and shipped according to the contract of his client, until we can draw with the documents on the German bankers.

The banks in Germany deal in this way with their customers. They accept the draft as mentioned before, if the customer can prove that the goods are sold and not bought on speculation, and he has to guarantee that the money he gets for the shipment later on will be paid direct to the bank. The official information about the client, the contract of his client and the information about the character and the financial standing of the American shipper are in the hands of the bank officials. What the banks want is to be sure that there is made a straight business and when it is proved they advance the full amount of the draft, which they keep in their hands until the goods arrive. Afterwards they give these papers into the hands of the clients to make the transactions when getting the material from the steamer, still being the owners of the documents. It will thus be seen that the bank has reserved every right on this lot, with the guarantee of the client to stand for every possible loss. When the goods are shipped to the client of the German importer, the bank draft or own acceptance of the spinner or open account is surrendered to the bank. The commission besides the interest charged by the bankers is very low, being not over 5/8 per cent., even when an open account is granted to the spinner.

The second difficulty is the question of differences in qualities. It is clear that the German spinners and importers have to be protected against shipping of inferior quality. It is a fact that linters do not run uniform like cotton with one bale like the other. In Germany all decisions are made through the Board of the Bremen Exchange, where sworn classers give the decisions. The opinion in the United States is general that the exchange decides in favor of the German concerns, which is untrue, as those classers when classing, do not get the names of the buyer and seller until they have made their decision. It is true that linters are hard to match on samples without seeing the bales, but the exchange is not to blame when some decision is given which is wrong in the opinion of our shippers here. The fault lies mainly in the following fact: The sealed arbitration sample is not made up as it should be, and handling of this sample upon arrival of the German port is done badly. The sealed sample should not be too small, but should weigh at least 2 to 5 pounds; and if the shipper knows that the grade he intends to sell does not run uniformly, he should show it in the sample by putting in some low quality stock, regardless of whether it might hurt the quick sale of the stock. He has to send three such samples of each grade to Germany, and one has to be deposited on the exchange.

It is better to show the spinner an exact type of the stock to be shipped, and ship exactly according to type, instead of a type that only represents the best in the bale, while it is impossible later on to ship up to the grade of this flattered type. It may be that some business will be lost through this fact, but it is doubtless that the business with this client is lost, when the first shipment declines and the arbitrations and all other troubles begin. Shipments which are exactly according to sample soon make a good reputation for the particular American shipper, and aid in building up a business at good prices, as the spinner prefers to pay a better price instead of getting shipments which are lower than the sample. On account of handling the sealed samples in the above mentioned way, when the spinner gets the difference of value in quality through the decision of the exchange, he is not as well satisfied as if he had received what he ordered. The reason is that he can't use the lower grade and must dispose of it and buy other stock lots for which he has to pay higher prices. When he has to get some further shipments of the lower grade from shippers, he tries in every way to turn down the contract, for instance, when the goods are shipped or delivered a day late according to the contract. On account of the strict laws he is forced by the exchange to keep his contract and those Germans which can't control here, have the troubles, lose the client and money, as it is hard to fall back on the shipper in the United States.

The controlling of the lots will have to be done in other ways in the German ports than it is done now. The shipper

will have to elect some forwarding agent in Germany who really controls the shipment and takes care of his interest. Sometimes they trust the controlling of the arbitration samples to their business connections. They don't know who they should elect, and even when they do elect one party, this party very often does not guard his clients interests as he should. They send a man out who stands idly by at the wharf and lets some other man draw the samples. The samples are usually drawn from the sides of the bales. These never could give an exact idea of the contents of the bale, as linters always contain layers of low grade stock, and when he unfortunately gets such a low one he pulls a great piece out, and as a result the sample which ought to represent the bale declines below the original sample, while it may be that only a few pounds of this low grade is in the bale. We should teach them to draw samples and to stipulate the method in the contract which is generally closed at the beginning of the season.

The sampling of bales should be done as it is practiced in this country, by inspecting the head and bottom of the bale, and after this is done to draw a sample from the side. And if this is not a good average, the bale has even to be opened. We often draw samples from the end of the bale, but they could not do it, because the bale is compressed. The man who controls for American shippers should refuse the sampling of the lot if it is not done as above outlined. When the samples are obtained in this way, then arbitrated on the exchange with sealed samples made up as stated before, it is very probable that the decision will be a clear one and satisfactory for both sides. The German shipper has to do the same with his customer.

ADJUSTMENT OF CLAIMS.

Claims can be settled in different ways and it is not easy to say which is the best one. First, the goods can be inspected in America by some competent man of the German firm, in which case claim would have to be filed here. This would be very pleasant, but in this case there is no reason why the German should buy the goods from some dealer here when he could buy it from the mills direct. This would bring us to the basis on which a firm handles business here when it has an office in America. The two other ways in which claims can be settled are the friendly settlement of claims, and the decision through the Board of Arbitration of the Bremen Cotton Exchange. The first way is a pretty expensive one showing many difficulties, through the cabling and both parties having a self interest. Germans are trying to get as much of a claim as they can, and the American tries to settle on the cheapest basis.

The difficulties have all been foreseen by the Cotton Exchange which gives the decision independently by experts in a way as we mentioned before. All German spinners buy their linters and waste on the basis of the rules of that institute, and it is hard for the German shippers to get orders on other special terms. The exchange decides a difference in quality by the sum of money according to the grade below the sealed type, and this decision is binding and must be paid, as the law takes this as an expert decision and does not go further into the matter, if such a claim is not paid and brought before the court. A decision can be appealed but once, but the appeal is not resorted to very much as it is expensive, in fact it is not often advisable. It is preferable to have a decision and a settlement through the exchange, as experience has shown that a friendly settlement often brings a greater allowance than a decision of the exchange would do. It will be seen that we ought to work on the basis of an arbitration of an exchange, say Bremen or Liverpool, which are about the same. If the shipment, making up the types and drawing of the arbitration samples are done in a right and fair way, there is no deception or wrong decision.

PAYMENT OF CLAIMS.

Claims which are decided have to be paid, and there are different ways of doing this. As experience has proved, many American shippers try to avoid making the payment of claims. They do not seem to realize that further business is lost. Every German merchant has to keep the terms he accepts and there is no doubt that no German buyer would order a single bale, when he knows, or at least is not sure that this claim will not be paid. The payments of claims can be done in the following way: The American shipper can make a deposit of a few hundred dollars with some independent person or bank in Germany, which deposit ought not to be withdrawn before all transactions are settled. As it has been shown that these deposits are often withdrawn or sometimes exhausted and not renewed, it is mostly asked from the German shippers that the draft be drawn on a certain percentage of the entire amount, say 75-90 per cent., depending upon the responsibility, character, and financial standing of the American linters shipper. The balance of the invoice value is retained as a margin until the goods have arrived, been inspected and the allowance fixed.

Another trouble often occurring in Germany is that instead of depositing this margin in the bank, the German shippers use this with their own capital, and often difficulties arise when the shipper wants the money in case they have not remitted promptly by check. This point has to be stipulated very strictly in the contract to protect our American shippers. When later on two firms get the proper confidence in each other through honest dealings this method of payment is not kept up so strictly by the German shippers and if they can really trust, they allow the draft to be drawn on the full amount. But this confidence can be shown only through experience or personal knowledge of both parties. If any delay in settlement of a justified claim happens, it is the custom to draw on 3d/s, and such drafts have to be protected accordingly, also such drafts have to be protected by our German friends, which are drawn for a delayed payment of the margins.

All in all, it would be the best when the banks of American shippers here would guarantee to pay any claim for their customer, if the claim is presented properly and according to the contract with the German firm, in which case we could draw on the full amount.

PLACING ORDERS FOR LINTERS.

The present method of ordering is also not a very good one. The German spinners ask usually for yearly contracts, to be shipped in monthly lots. This business amounts to a future business and troubles are the result on both sides. We ought not to offer more stock than is in sight or in the warehouse, but make sales for a short time ahead, when we can control the market.

It is hardly advisable to make contracts for delivery 8 or 10 months later on, as linters are not cotton, and we have to ship certain grades to avoid losses and troubles, and even when we are contracting here for the outputs of oil mills, it is known that the quantity of the stock is variable, while we have to ship a certain number of bales on contract. When we fall short we have to stand the difference. On the

other hand we may get too much, and be unable to dispose of it as the concern won't take more or less than ordered. We could sell here for later shipments by putting the stock in our warehouses, but it is not a good plan to tie up money for this purpose during the season. In this case it would be a help if our banks here would warrant the bonded warehouse receipt as usually done in Europe, and would advance a certain percentage for those stocks which can be proved as sold. To sell for late future shipments is nothing more than a speculation, and when the prices rise the shipper has to buy the goods at a loss as he has to ship in a certain month and he finds that he has made the fault by accepting such orders. Then he tries to turn down the contract, or ship lower quality though he has then to pay enormous claims, which are justified when he ships very light bales, and all this other small tricks which hurt the business. If we do not accept such orders, we could force them to order instead of once a year, several times. When the market can be controlled, consignments could be made, and our German friends are always willing to advance high percentage on them, as stock lots bring good prices in Germany as they are handled there on personal inspection and bring satisfaction to the spinners, as they get the stock they want, while goods bought on shipment don't always come out as they ought.

The export business with Germany and Austria can be done on a profitable basis and would be welcomed by all dealers in domestic trade, as there would be another chance to sell the goods if we can't place the stocks here, and Germany buys nearly every quality, from the high grade Sea Island to the lowest Texas or short stapled green lint, paying as good price as we can get here. But the business has to be handled by experienced men and who want to deal in a straightforward way to continue the business from year to year. The expenses are comparatively low, as there is no need of traveling, and the only cost is for some sample materials and the cables, which can be reduced on account of the private and special general codes.

It may be that these few words which will be read by our German friends also, will do some good on that side as well as here, and will aid me partly ridding the trade of the present difficulties connected with it.

Technical Education in India.

Ahmedabad, which is one of the largest centers of the cotton industry of India, is now in possession of a Technical Institute worthy of its many enterprising citizens. Its inception took place some 2½ years ago, when His Excellency, Sir G. Clarke, performed the ceremony of laying the foundation stone. The work has progressed steadily, and the present year has marked its completion, and the ceremony of its opening for the use of students.

The marked advance in the exports for the month of September is largely due to heavy exports of cotton at unusually high prices, the cotton exports of the month amounting to 399 million pounds, valued at 55 million dollars, an average of 13.7 cents per pound. The quantity of cotton exported was larger than in any September since 1904, the value larger than in any September in the history of the export trade, and the export price per pound also higher than in any earlier September since 1875.

MANCHESTER, THE GREAT MILL CITY.

A BRIEF ACCOUNT OF THE HISTORY AND A PICTURE OF PRESENT-DAY WORK IN THE GREAT COTTONOPOLIS.—THE OPERATIVES.

(*Contributed exclusively to* COTTON.)

BY TEXTOL.

The history of Manchester, England, as a cotton manufacturing center is the only history of Manchester that counts. England is the largest producer of cotton goods in the world, and Manchester is England's cotton center. Great Britain possesses over 53,000,000 spinning spindles, the United States coming next with about 27,000,000. The cotton operatives engaged in spinning and weaving in Great Britain number in round figures quite 600,000, and probably there are another 600,000 employed in the subsidiary industries and employments connected with cotton.

CARD ROOM IN A MANCHESTER MILL. NOTE THE FOUR ENDS UP AT THE DRAWING FRAME.

The total amount of raw cotton imported into that country in 1909 was worth over $300,000,000, two-thirds of it coming from the United States.

The great development of Manchester has come within the last 30 years, and it appears to have always been a busy place even two hundred years back when one could have walked through it in two or three minutes. The early days of the cotton trade in Manchester were days of hand labor, although history records cases of primitive machinery being driven by dog power. In 1788 Manchester imported 22,800,000 pounds of cotton and exported cotton goods to the value of about $5,000,000. A year later saw the erection of the first steam engine for spinning cotton. In the year 1800 the importation of the raw material had reached 56,000,000 pounds annually, and the value of the cotton goods exports touched nearly $28,000,000. Up to about the beginning of the last century, most of Manchester's raw cotton came from the West Indies, the French and Spanish colonies, Brazil, Smyrna and Turkey generally and a few other places. In the year 1784 eight bags of cotton were seized by the customs authorities on an American vessel arriving at the port of Liverpool, the impression being that the cotton could not be a product of the United States.

In the first decades of the 19th century, silk became an important Manchester industry. In 1819 there were about one thousand weavers of mixed silk and cotton in the city; the first throwing mill was established in 1820, soon em-

ploying no less than 5,000 people; and from here the trade grew until, in 1832, the raw silk consumed in Manchester amounted to 800,000 pounds annually. It is on record that in that year in Manchester and the district, there were in operation 96 cotton mills, 16 silk mills, 4 woolen and worsted mills and 2 flax mills. Two years later the quantity of cotton retained in Great Britain for home consumption was 295,684,997 pounds, whilst the export of cotton yarn amounted to 76,478,468 pounds.

The first severe financial shock Manchester had to bear was in 1825. A period of wild speculation had set in which was encouraged by the inflation of the paper currency. The country was flooded with bank notes and many of these of the face value of five dollars each had been issued by provincial banks regardless of consequences. The only end of this was a money panic when temporarily, and in some cases permanently, these bank notes became only so much waste paper. Sixty banks stopped payment and a tide of bankruptcy swept over the country. Cotton suffered. Hundreds of mills were closed and tens of thousands of operatives flung out of employment. For the next year or two there was severe distress in Lancashire, riots, mill burning, poverty and destruction. Yet out of this panicky period sprung the beginning of the railway system which was to link up Manchester with all its surrounding neighborhoods and the country at large. These railways when finally completed by the famous ship canal, made Manchester a distributing center of the first importance.

There is not room here to detail the gradual growth of this vast center. It is sufficient to say that a modern idea of the scope of the city's industry is obtained by a walk through the home trade warehouses in Manchester engaged in the distribution of manufactures within this country. The cotton after being converted into yarn or cloth and after having undergone one or two of the further processes —finishing, bleaching, dyeing, printing and making up into pieces, or being converted into all sorts of useful articles— is finally packed up for distribution. The warehouses will show you samples in all these finished products. Floor after floor is packed up with linens and dye goods of every conceivable variety, bulky packages and piles of bleached calicoes, fustians, velveteens, quilts, counterpanes, toilet covers, French merinos, plain and fancy dress goods, worsted damasks, muslins, curtains, Turkey twills, table covers, sateens, cretonnes, shirtings, flannelettes, and all the rest of that vast series of cotton manufactures. Work begins early in these Manchester warehouses. The mail is opened at half past seven in the morning and from that time until the finish of work there is little slackening of the toil. The Manchester business man is not a pleasure lover, he lives for his work.

PACKING AND SHIPPING HOUSES.

A shipping house is also extremely interesting. There are quite eight hundred merchant firms in Manchester engaged in negotiating shipments of merchandise to and from all parts of the world. The packing rooms become studies in universal geography. In a big packing house as you pass by office after office, you will find correspondence being done in all the languages of the East and West. These shippers have their warehouses, where goods are received, examined and passed on to the packers with instructions as to their destination. The features of the actual packing rooms are the great piles of merchandise, the forest of hydraulic presses and the bewildering variety of packing materials. Here the goods are made up into bales, covered with canvas, and bound round with iron bands. These bales or trusses differ much in size and weight and form of packing, to comply with the various requirements and forms of transport of the different countries for which they are destined. Very remarkable expedition is often shown in dealing with goods when the need is urgent. 2,500 pieces of China shirtings, received at three o'clock in the afternoon, will be made up, packed, and delivered in bales at the railway station by half-past six in the evening.

This packing is done by means of hydraulic power. It is a very interesting process, and for which special hydraulic mains have been laid down, and a pressure of water power afforded at the pressure of 1,000 pounds to the square inch. By this means special engines and boilers are not required on the premises, for the power is supplied from a central station—the hydraulic pumping station. The

DRAWING-IN ROOM IN A MANCHESTER MILL.

required machinery does not cover a large area, although they are various, and the processes very interesting. In the first place the coal is landed from the barges on an adjoining canal, and is lifted, by means of a hydraulic crane, on to the roof of a coal shed, and conveyed to the interior by means of shoots. It is there conveyed, by an ingenious mechanism, in buckets to the boilers some distance away, and there fed into the fires without any intermediate handling.

Above these boilers are three great tanks, into which you see the water pouring out from the low-pressure mains, and at the same time, hot water supplied from the condensers in the engine room for the purpose of raising the temperature of the water generally, and preventing freezing in winter. Below these tanks, on the other side, is the boiler house. There are five boilers, fitted with economizers and all other modern mechanical appliances, enabling one man to attend to the whole. From the boiler house you pass into a lofty, spacious, and bright-looking engine room, with six upright pumping engines. If you watch the movements of these engines you will note that they show variations in speed. These movements, apparently so irregular, are, nevertheless, automatic, and are influenced by the varying demands of the users of this hydraulic pressure. These variations will be further in evidence when you see the accumulators by which the aggregate pressure is maintained and conserved.

These accumulators appear to be like two great pillars of iron, round which are placed two gasometer-shaped con-

structions, also of iron, and capable in each case of moving up and down the enclosed pillar. While one of them is in motion, rising and falling, and so hiding or disclosing the pillar, the other is elevated and stationary. Within each of these two pillars is a movable ram, which communicates with the water as it is being forced into the mains, and is acted upon at its summit by the weight of the outer case, which is loaded with about 140 tons of slag. When this is seen descending it means that power is being used outside, the equilibrium of which is maintained, by being forced back again by the engines, after it has descended. The gauge on the wall shows that the pressure is being maintained at a little above 1,000 pounds to the square inch. The second accumulator—not in motion—is always held in reserve.

By this centralization and distribution of hydraulic force, packers are enabled to make use of this initial pressure. But as, very often, a heavier pressure is required, another hydraulic contrivance, called an intensifier, is employed, by means of which the presses of a great packing house, worked with the required power, are capable of being variously applied up to 5,500 pounds to the square inch.

MANCHESTER COTTON MILL OPERATIVES.

The cotton mill operative is usually a thrifty worker. Small wages are meant to go a long way and yet, so far as the operatives are concerned, the pleasures of life are not included. Most of the mills run holiday funds into which operatives pay throughout the year, drawing out a lump sum when the holiday week comes round. This is spent during the week, and Blackpool is the great seaside watering place to which the cotton and woolen mill operatives direct their steps. Blackpool is undeniably the greatest amusement center on the English coast. From small beginnings it has grown up to be a huge holiday center, and links up now three or four other seaside towns giving an enormous extent of beach. Music and dancing figure largely in the operatives' regular amusements. Some of the finest amateur brass bands in the country hail from Lancashire, and are financed, organized, and membered by mill operatives. The universal wearing of clogs makes clog dancing a county feature, with clog dancing championships to be competed for. The mill girl is a not unpicturesque type in her clogs and shawl, and many merry and effective pictures of her are found in the popular music hall songs of the period. Working on equal terms with the men in the mills, doing much the same work, but unfortunately for much lower money, she has an independence of character that is unusual in her sex. Furthermore, usually she is a strong believer in trade unionism as is the male mill worker, and it is to be noted that it was in a Lancashire mill town that the first Parliamentary candidate, standing wholely and solely upon a woman's suffrage platform, was found.

FARM MACHINERY published by the Midland Publishing Company, St. Louis, Mo., have brought out a new text book entitled "Cost-Accounting Pathfinder," which takes up this very important subject in an interesting and careful manner. While several different items are treated in a general way, the book is designed especially for store keepers and merchants in general.

TO MEET IN RICHMOND, VA.

The Board of Directors of the American Cotton Manufacturers Association met at the Waldorf Astoria in New York City, on October 19th and chose Richmond, Va., as the next meeting place for the annual convention of the Association in May next. This will make the third time within the last four years that Richmond has been chosen as the meeting place of the Association. Owing to the vacancy on the Board of Directors caused by the death last summer, of Charles K. Oliver, Baltimore, Md., chairman of the Board, W. E. Hooper, of Baltimore, Md. was elected to the Board of Governors, and W. A. Erwin, of West Durham, N. C., was elected chairman of the Board.

Following the meeting of the Board of Governors of the American Cotton Manufacturers Association, a joint meeting was held by this Board and the Board from the National Association of Cotton Manufacturers, at which time the subject of the uniform sales contract was discussed. The Board of the National Association was the host of the American Association Board at a banquet held at the Engineers Club. The subject of having the two associations hold a joint fall meeting was discussed informally and was looked upon with favor by those in attendance. It is well known that the National Association holds its business meeting in the spring in Boston, and its semi-annual meeting in the Fall, and is devoted largely to social pleasures. The American Association at present, only holds one meeting annually in the Spring.

The joint meeting in the Fall will in no wise interfere with the individual business meetings of the two Associations.

COTTON BILLS OF LADING.

The latest development in the plan to guarantee cotton bills of lading to English bankers, was the extension of the period in which the present agreement obtained, from October 31st to December 31st. This arrangement was agreed to by English bankers in order to give the necessary time to work out a plan for guaranteeing the bills of lading by a guaranty company, which, in the opinion of the subcommittee of the American Bankers' Association, is the only logical method of dealing with the subject.

The conference between representaties of English and American bankers was held in New York City at the Corn Exchange Bank on Oetober 11th, the English bankers being represented by Sir Edward H. Holden, managing director of the London City and Midland Bank and chairman of the London Conference Committee on cotton bills of lading, the committee from the American Bankers Association being composed of Joseph H. Talbert, Vice-Pres. of the National City Bank; W. A. Nash, Pres. of the Corn Exchange Bank; Gilbert S. Thorn, Vice-Pres. of the National Park Bank; William H. Porter, Pres. of the Chemical National Bank; Walter E. Frew, Vice-Pres. of the Corn Exchange Bank; Fred Kent, Sec. of the committee and Vice-Pres. of the Bankers' Trust Co., and Jno. E. Gardin, Vice-Pres. of the National City Bank.

The original demands of the foreign bankers were cabled from London during the conference, as follows:

"In consideration of you, the importer, procuring the acceptance of the undermentioned bill of

lading, and of you, the bank, accepting the same, we hereby guarantee to you and to each of you severally that the said bill of lading is valid and genuine and has been signed by the agent duly authorized by the carriers therein named, and that at the time the bill of lading was issued the cotton therein referred to was in the actual custody or under the control of the issuing carriers. Our liability hereunder is limited to the amount of the said bill of exchange."

The proposition for a bank guarantee by American institutions was said to be both impractical and illegal under American banking laws.

Another proposition was submitted in which was planned a guarantee company to be organized under English laws to guarantee bills of lading, the cost to be about six or seven cents a bale on all cotton shipped to European ports. In order to ascertain the sentiment of Southern bankers and factors, a telegram was sent out by the New York Cotton Exchange, as follows:

"Have been in conference with a representative foreign banker and New York bankers and foreign exchange buyers. The only apparent solution of present difficulties is in the nature of a guarantee guaranteeing the validity of the bill of lading in connection with railroad validation certificate. A foreign company will be organized to guarantee this risk at a cost of six or seven cents per bale. Please place this matter before your members and wire William A. Nash, president of committee in New York as quick as possible whether the plan will be acceptable to your body."

Without exception, Southern bankers and cotton exchanges replied that they were opposed to the levying of such a tax on the American grower, as unreasonable, pointing to the fact that exporters of other commodities are not obliged to guarantee the bills of lading, and furthermore that the losses sustained by frauds last year amounted to only one-half of one per cent. of the amount involved in the cotton exported. It has been calculated that to guarantee 7,500,000 bales at the rates favored would cost about $500,000 a year to the cotton grower. The action of the Southern bankers and exchanges, in refusing to accept the proposition, made it necessary for the English and American bankers in conference to have a longer time in which to arrive at a satisfactory agreement, and hence the extension of the period in which the present agreement obtains from October 31st to December 31st.

The statement given out by Sir Edward H. Holden is as follows:

"Since Thursday last communications have been received from so many of the interior bankers in the States agreeing generally to a guarantee by a guaranty company, surety company or insurance company, being given to the European bankers, that Sir Edward Holden, who has been here negotiating with the American bankers, feels himself justified in recommending and has recommended to the European bankers to extend the date for the negotiations of cotton bills on present lines from Oct. 31 to Dec. 31, such period being considered necessary for the perfection of a method for the safe-guarding of bills of lading which will also protect the European bankers from the issue of forged bills of lading and forged validation certificates by persons outside the railway companies and of which the railway companies can have no cognizance.

"The European bankers have agreed to this extension on the understanding that the right is reserved to them to further consider in conference with the American bankers, if found necessary, other schemes of protection if the guaranty or insurance proposal should be found to be impracticable."

This decision practically means an agreement, as the majority of the cotton to be exported this season will have been sent across the water by the expiration of the agreement, and will also give sufficient time for due deliberation in arriving at an agreement satisfactory to all.

BUILDING NEW MILLS TO EXCESS.

VIEWS OF A WELL KNOWN SOUTHERN MANUFACTURER.

S. B. Tanner, president of the Henrietta Mills, and ex-president of the American Cotton Manufacturers Association, in a recent interview in the Charlotte Observer, calls attention to the enormous activity in cotton mill building and sounds a warning note to the industry that the production shall not outstrip the demand. Mr. Tanner said:

"If this cotton crop is as short as it is now generally believed to be, the congested and depressed condition of the cotton mills will soon be relieved just as the worn-out and almost starving farmers were relieved from the effects of selling an oversupply of cotton below the cost of production years ago. But this relief came only after they had lost whatever surplus they had and in many cases after they had actually lost the farms themselves. In those days the farmers showed no indication of having sufficient business capacity to relieve themselves of overproduction by diversifying and making something else beside cotton until Providence came to their aid by giving them a short crop, which convinced them that a short crop would bring them more money than a large one and that they could make a better living by diversifying and making less cotton and more grain and other products. This change and the realization of this fact have placed them upon a solid basis and they are now doing well.

"The cotton manufacturers are now passing through exactly the same experience and so far have shown themselves no more capable of looking after themselves, with all their vaunted business experience, than was the farmer years ago. It seems that this country has been trying to build cotton mills to supply the entire world with goods while the foreign countries have been trying to do the same thing. Consequently the facilities for manufacturing cotton goods have nearly doubled the world's capacity to consume them and unless we have a crop below the requirements of the world so that the mill men will be forced to curtail and diversify their investments in other channels until the world can consume the production of the mills now in operation, the industry will experience the same disaster as that which befell the farmers.

"Investors in new mills will no doubt be enlightened and surprised to learn that the 'Blue Book,' a textile directory, advertises a list of 560 new mills for the past year in addition to the already overproduced market. It is considered by some people almost criminal now instead of

being beneficial to the country to build cotton mills, not only because of the uncertainty of a profitable investment but for the reason that the employes can not hope to get regular employment and they are likely to be a charge and burden upon the community in which they are located instead of a benefit and a source of wealth as should be the case under normal conditions."

THE INAUGURATION OF THE TEXTILE INSTITUTE.

(Contributed exclusively to COTTON*)*

BY FRANK NASMITH.

Although the Textile Institute originated in Manchester, England, and up to the present time embraces only British members, it is proposed to make it entirely international in character. Curiously enough other countries have been better provided with representative associations than has Great Brtain, although there have been a great number of minor and local societies which have for many years done excellent work in that country. It was the belief, however, of the originators that the industry would be best served by the more extensive application of scientific methods. Although it is not the writer's wish to deprecate the work of existing associations it is in his opinion highly essential that the work should be of a more effective character than is produced by the mere reading of papers.

There are many sections of the industry which can be materially benefited by a body which will inquire into the conditions existing and remove defects which it may be impossible for the members of that particular industry to adequately deal with themselves. Take a particular instance in Great Britain. For years the Silk Association has been endeavoring to obtain better treatment in regard to railway rates. Although much good work has been done and certain concessions obtained, yet with the backing a powerful Institute can afford, there should be a very much greater chance of settling the grievances existing in a comparatively short period of time. There is work for such an Institute in connection with the supply and marketing of raw material for every branch of the textile industry, not only of cotton, but wool, silk, flax, hemp and jute.

Needless to state when the scheme was formally proposed to a representative body of gentlemen connected with the textile industry it was eagerly taken up. Several meetings were held in Manchester between the 20th July, 1909 and the date of the Inauguration of the Institute on April 22nd, 1910.

Before dealing with the inauguration it will be as well to briefly outline the objects of the Institute which are:

(a) Arrange for the holding of meetings, the reading of papers, and the giving of lectures, with subsequent discussion and publication.

(b) Print and circulate an Official Journal of the Institute. This Journal shall form a systematic and permanent record of papers read at meetings of, or communicated to, the Institute. It may also contain abstracts of technically important matter appearing in other publications, abstracts from patent records relating to the textile industry, and such other matter as the council may decide upon.

(c) Constitute an authority for the determination and recognition of technical and trade standards, usages, terms, definitions, and the like for the textile industry.

(d) Obtain statistical and other information regarding the production and use of raw and manufactured textile material.

(e) Foster the systematic study of problems affecting power supply, lubricating, lighting, heating, drying, humidifying, ventilating, mill construction, and allied subjects in their relation to the textile industry.

(f) Promote the perfecting of present methods and the inventing of improved methods and otherwise dealing with problems concerning: (1) Growing, obtaining, preparing, and packing raw materials for textiles; (2) manufacturing yarn and cloth; (3) bleaching, dyeing, printing, finishing, and other processes relating to textiles; (4) transportation and application of all textile materials—raw and manufactured.

(g) Encourage, by the giving of prizes, scholarships, grants, and other awards, original work and research dealing with: (1) Natural and artificial fibrous materials; (2) the constitution, properties, and application of dyes, sizes, and other substances used in, or pertaining to, textile processes generally; (3) methods of testing textile materials by chemical analysis or by mechanical means; (4) any other work of a like nature pertaining to the textile industry, and requiring skilled application and study.

(h) Appoint special commissioners to investigate and report upon problems and processes pertaining to the textile industry, and to give remuneration for such services.

(i) Provide facilities for establishing, collecting, maintaining, or preserving such buildings, machinery, records, and other material as the council may consider of sufficient historical and educational importance.

(j) Acquire and dispose of property for the purposes aforesaid, and do all other such things as in the opinion of the council shall aid in furthering the object of the Institute.

It can not be denied that any industry may be readily advanced by: (1) Lowering the cost of raw material; (2) lowering the cost of production by the substitution of apparently inferior material; or by substituting machinery for hand labor; or by the introduction of entirely novel processes and of improved machinery; and (3) the discovery and exploitation of new markets, and of new uses for the products.

Science and technology will undoubtedly help the industry if properly applied, and it is the main object of the Institute to break down the insular barriers which have hitherto existed between scientific instruction and commercial life. At the inauguration ceremony on April 22nd, 1910, the Right Honorable Sydney Buxton, President of the Board of Trade, specially visited Manchester to be present, Lord Rotherham, of Broughton (then Sir William Henry Holland Bart) was elected president of the Institute and the following gentlemen heads of their respective branches of industry were elected Vice-Presidents: CHEMICAL—Mr. Max Muspratt, M. P.; COTTON—Mr. C. W. Macara; EDUCATION—Sir Philip Magnus, M. P.; ENGINEERING—Sir William Mather; HEMP & JUTE—Mr. William Henderson; LINEN—Sir William Crawford; SILK—Sir Arthur Nicholson; WOOLEN—Sir Mark Oldroyd; and WORSTED—Sir William B. Priestley, M. P. The members of the council were then elected, all being representative of the great textile industries. The speeches at the subse-

quent dinner were excellent and held out great promise for the future work of the Institute. Since the inauguration the work has been well carried forward and the excellent congress held at Bradford on September 8th, 9th and 10th showed that really good work was being done. It is the intention of the council to undertake at once some work which will be of direct benefit to the textile industry and at the moment a scheme is before them which it is hoped will prove their earnest purpose and effective usefulness.

GASOLINE MOTOR TRUCKS vs. ELECTRICS.

(*Contributed Exclusively to* COTTON.)

BY A. N. BINGHAM.

The fact that motor trucks are more economical than horses under certain conditions has been discussed and proven in a previous article in this magazine. Satisfied that such motor trucks are a profitable investment, the progressive business man will next ask himself the question, which shall I buy, gasoline or electric? Which is the more practical? To decide these questions let us see what the elements are which go to make up this quality of practicability. Are they not efficiency, reliability and economy; or getting down to plain English, work and cost?

Leaving the item of cost for a later discussion, what are the principal claims for the electric vehicle? (1) Simplicity in operation, requiring a less efficient driver; (2) gradual application of power, thus eliminating all jerks in starting; (3) no likelihood of engine trouble on the road; (4) more uniformity of service and (5) does not interfere with fire insurance in buildings and on steamship piers.

Against these then are claimed for the gasoline motor truck: (1) Ability to go any distance without stopping to charge batteries; (2) no danger of running out of power or inability to get more power on the road; (3) plenty of power to carry full loads under all normal conditions at a reasonable speed; (4) no difference in power, owing to climatic conditions, worn batteries and cold weather; and (5) less wear on tires per mile, as the great weight of the batteries does not have to be carried around. The sum total of these claims is brought out, however, when the final test is applied, that is, what ton mileage can be delivered per working day and per year.

It has been shown that horses can make from 15 to 20 miles per day, and in order to be economical the motor truck should be able to cover double that distance or else do the same mileage and carry double the loads. It must be borne in mind that when an electric truck's power gives out on the road it is necessary to tow it back to the garage or to a charging station for more current. With a gasoline truck, sufficient fuel can be carried for two or three days' service and further gasoline may be procured at almost any village. For this reason practically all of the heavy hauling for suburban districts and inter-city trade is being done by gasoline trucks. Many large companies using electric vehicles for their city deliveries only, have gasoline trucks for their out-of-town work.

Several of the larger companies whose trade is within city limits alone, use electric trucks exclusively. These after making their morning haul can be brought back to the garage and be given a "boost" or enough additional current to send them out again on a short trip in the afternoon; but in all cases the daily mileage is limited, say on a five-ton truck to a maximum of about 35 miles a day when the batteries are new, running down to 20 miles or thereabouts when the batteries have become worn. They also lose efficiency in cold weather and the operating speed is considerably under the proper running speed of gasoline trucks. The latter of the same tonnage capacity will cover 50 to 60 miles in one day.

Of course when mileage is a secondary consideration and when there are very frequent stops and starts, an electric truck serves a useful purpose, as there is not a continual jerk on the mechanism by throwing in a clutch.

Although frequently condemned in pleasure cars when a variable speed of from 10 to 50 miles an hour is required, the planetary gear box in a motor truck is the most endurable, as there is practically no wear, and the load is put into motion by a gradual, steady band grip and without a jerk. This approaches very closely the easy way in which electric power is applied.

Gasoline engines, such as are designed especially for the hard work of the best trucks, are perfected to such an extent that road repairs are seldom necessary. But in no case should an inexperienced driver be entrusted with a piece of machinery, either electric or gasoline, costing several thousand dollars, as an accident alone will in the majority of cases more than offset the difference in salary between a good man and an incompetent one.

Summed up, then, the situation is almost the same as has been developed in the use of the pleasure car; for long hauls and heavy work gasoline trucks are more serviceable, when for lighter work and city delivery electric trucks can show good results, although in the opinion of the writer, the gasoline truck under similar conditions and with a careful chauffeur, will accomplish as much as the electric and even more. The question of which type of vehicle is more economical will be discussed in the next article.

Embroidery Looms From Plauen.

From August 1, 1909, to the end of June, 1910, 146 shuttle embroidery machines, such as are used in the manufacture of laces and embroideries in Saxony, were shipped to the United States. Their total value, with extra parts, was $242,002. The 18 looms, valued at $31,919, shipped during June, 1910, were like those ordered by American customers during the previous 11 months—all of the high spanned model, with boring apparatus. In June, 1909, only 4 looms, with extra parts, valued at $6,395, went to the United States.

Application has been made to the South Carolina railroad commission by the owners of 113 cotton mills for a reduction in rates from Spartanburg, Greenville and Columbia sections to the port of Charleston, S. C. Textile men want to make this city a concentration point, but assert that hey can not do so unless hey are given a commodity rate of 20 cents on carload shipments and 22 cents on all other shipments of cotton goods, from the mills of the Spartanburg and Greenville sections to Charleston; also a commodity rate of 16 cents on carload lots and 18 cents on all other shipments of cotton goods from Columbia mills to Charleston. The commission has given a hearing on the application and its decision is awaited.

COAL AND ITS ECONOMIC USE IN COTTON MILLS.

BY J. S. BURROWS, FUEL EXPERT, CASTNER, CURRAN & BULLITT, NORFOLK, VA.

One of the most important supplies which demands the attention of the great majority of our mill managers is the coal used for the production of power. This supply generally represents a considerable amount of money, and next to labor is probably the greatest single item of expense. Some knowledge of the technique of coal would therefore seem to be of importance to the mill manager, both as concerns the material itself, as well as its proper and economical use.

Such knowledge should embrace (1) an understanding of the relative values of the coals available in any locality; (2) a knowledge of the factors which make up the delivered cost of the coal, and their influence on its value; (3) an appreciation of the responsibility of the various competing suppliers and their ability to meet requirements during strikes or under other adverse conditions; (4) a clear perception of the sources of waste in the boiler plant, and the proper steps to be taken for their correction; and as experience is gained, (5) the development of a simple, systematic routine for boiler-house and fuel accounting which will not prove a burden to the manufacturing end of the business.

Instead of starting at the beginning and taking these questions up in regular order as enumerated above, it would seem advisable to begin in familiar surroundings and with this end in view I invite each of you to mentally step down into your boiler-room and observe closely what is taking place there. We will assume that a good grade of semi-bituminous coal is being used, and that the plant has been running for several hours so that the fires are in normal condition, and the usual load is on the boilers. When the time for the next firing arrives, a charge of coal is thrown on the grate in varying amounts, according to the plant and the skill of the fireman, and an interesting chemical process begins at once. The fresh coal absorbs heat from the hot coals beneath, during this time taking heat that would otherwise be available to the boiler. When heated to the boiling point of water, the moisture of the coal is expelled and passes off without producing any useful results. At a slightly higher temperature the gases of the coal begin to come off—combustible gases which are valuable and which give their full quota of heat when liberated under proper conditions for combustion. These gases constitute the so-called *volatile matter* of coal, and are perhaps the most troublesome constituents met with in endeavoring to burn coal economically.

In *semi-bituminous* coal, the kind used in this illustration, the volatile matter ranges from 15 to 20 per cent., while in *bituminous* coal it varies from about 20 per cent. to as much as 40 per cent. Coals containing the higher percentages of volatile matter require a specially designed furnace of large dimensions and a degree of skill seldom found in the average boiler-room to burn them to the best advantage. On the other hand, semi-bituminous coal (15 to 20 per cent. volatile matter) seems to have been designed by nature for steaming purposes, as she removed a large amount of the troublesome volatile matter in preparing the coal for man's use.

To continue with our observation of the changes which are taking place in the freshly fired coal, after the volatile matter has all been distilled there is left of the coal carbon and ash. This will be found to consist of a more or less solid mass of coke. It has ignited at a temperature of about 750° F., while the volatile matter was still in process of distillation, and is now at a bright red or orange heat, and is returning to the furnace the heat required to raise it to the ignition point. This coke, less the ash, is represented in an analysis by the "fixed carbon." It is really the most valuable constitutent of the coal. Fixed carbon ranges from 50 per cent. in bituminous coals to about 72 per cent. in semi-bituminous coals.

Next to the grates will be observed a thin layer of ashes, pieces of which are constantly falling through the bars into the ash-pit. Immediately above this is a layer of decrepitated coal or coke which gradually merges into an incandescent zone of white-hot coke, above which lie layers of coke and coal in various stages of combustion, according to the state of the fire. In the example before us we have already observed that the top of the fuel bed was coked into a more or less solid mass and is burning at a bright red or orange heat. Now if we use a hoe, or other appropriate tool, to break up this coked mass a change is instantly perceivable. The fire burns at a white heat. Standing in front of the open door it is almost unbearable, and if you will look at the steam gauge you will observe that the pointer is slowly "going up." How did the breaking up of the mass of coke produce this result? Simply by making more passages for the air to come up through the grate and fuel bed.

This brings us to the question of air supply, of which there is none more important. It is, of course, well known that air is essential to combustion, but it is probably not so well known that we burn more air than coal. The proportions are something like 15 tons of air, or more, to one ton of coal. Fortunate, isn't it, that we buy the coal and not the other equally essential element to combustion?

Without going too deeply into this scientific side of combustion, it should be remembered that it is not possible to save all of the heat which ordinarily goes up the stack, as a portion of it, where a fan or blower is not employed, is necessary to maintain the draft. A stack temperature of about 450° F. is generally considered sufficient for this purpose, under ordinary conditions.

As a general rule, the air supplied for combustion should be admitted solely through the grates, as in that way it not only comes in contact with the highly heated carbon, or coke, but the excess in passing through is heated to a sufficient temperature to enable it to combine with the volatile matter and cause that constituent to burn smokelessly and with useful results.

THICKNESS OF THE FIRE.

We have seen the necessity of keeping the fire at an even thickness all over, but we have not, thus far, considered how thick it should be. The depth of the fuel bed to be carried depends on the draft and can only be determined for each plant by experiment. It is obvious that a thicker fire may be carried with a strong draft and a thin fire must be carried with a weak draft. It is also obvious that the stronger the draft the more coal it is possible to burn in a given time. When the steam produced is insufficient for the requirements every effort must be made to increase the draft, by lengthening the stack if necessary,

or making other changes in the plant which will produce the desired result.

Presumably, we have been in the boiler-room during this discussion; suppose we now go outside and examine the ash heap. We find it composed of non-combustible material, or ash, and small pieces of coal and coke. If we should take the trouble to separate the coal and coke from the ash, we would find that the percentage of coal ranged from a few per cent. up to 40 or 50 per cent., according to the skill of the fireman. A small percentage of this coal is unavoidably wasted in cleaning fires, but with proper management it can be reduced. Every time the fireman runs the slice bar over the grates a lot of good coal is shaken down into the ash pit, and the more often this tool is used the greater is the loss of fuel. At the majority of plants the use of the slice bar is seldom necessary and its use should be restricted if the coal pile is to be conserved. A great many firemen seem to believe that a fire has to be literally torn to pieces to obtain the necessary heat from it and consequently show a decided partiality for the slice bar. The only tools required for economical firing are a small size shovel and a two-pronged hook, the points of which should not be over three inches long. The fuel bed should be broken up from the top with this hook, the tynes of which are not sufficiently long to reach the grates and force good coal into the ash pit.

Another word about firing. We have seen that it takes time for a charge of coal to heat up and become an efficient part of the fuel bed. It follows then that the more coal we put on at a time the longer the fuel bed will be delivering heat to the new charge of coal instead of to the boiler, with the result that we have a series of alternating cool and fiercely hot conditions in the furnace which are neither conducive to economy nor helpful to the life of the boiler. Conversely, it follows that the less coal put on at a time the more uniform are the furnace conditions as well as the delivery of heat to the boiler, and while this may mean a more frequent opening of the door, which temporarily arrests the draft, there is little danger of carrying this method of firing to excess, as the physical endurance of the fireman is the controlling factor.

To summarize the losses which occur in using coal, we have seen that they consist principally of:

1. Loss due to expelling the moisture from the coal.
2. Loss due to non-burning of the volatile matter.
3. Burning of the carbon of the coal incompletely through deficient air supply; and,
4. Loss of coal or coke through the grates.

In these days of recording steam gauges and meters, water weighing apparatus, draft gauges and CO_2 recorders, you can make this information as elaborate as you like, and for the larger plants there is no question of such data proving of inestimable value to the management.

There are few plants to-day which do not in some way measure or weigh the coal daily and their managers are wont to regard the figures as a measure of the day's work. Quite likely many of you who count the number of wheelbarrows brought in each day, after having weighed one barrow as a check, have noticed wide discrepancies in summing them up for comparison with the car weights.

The only safe way to find out how much coal is being burned each day is to weigh every barrowful from every car on scales kept free from coal and in good working order. Any scheme of measuring the coal is liable to an accumulation of errors, and can not be taken as a criterion as against the car weight which is determined in one operation on automatic, recording scales, kept in perfect adjustment and constantly inspected.

Having ascertained the conditions which are to be met with in the use of coal, we would now do well to look into the question of coal supplies, and particularly the characteristics and value of the different coals. Analyses are useful in this connection and tell us the character of the coal, whether bituminous or semi-bituminous, and its heat producing value. The percentage of volatile matter indicates the class to which a coal belongs and the calorific value stated in British thermal units, generally abbreviated "B.t.u." tells us its heat-producing value. Fig. 1 gives a

Order of Value	NAME OF COAL	KIND OF COAL	STATE	ORIGINATING RAILROAD	AUTHORITY FOR ANALYSES	No. of Samples Averaged	Moisture, %	Volatile Matter, %	Fixed Carbon, %	Ash, %	Surplus, %	Calorific Value, B. T. U.
1	Pocahontas	Semi-Bitum'ous	W. V. & V	Nfk. & Western	Boston Cha.Com.	118	2.83	17.46	72.64	7.07	0.68	14.278
2	New River	" "	W. Va.	Vgn. & C&O	" " "	395	2.98	20.44	70.26	6.32	0.98	14.260
3	Chambria Co.	" "	Penn.	PRR & NYCRR	" " "	338	2.53	19.08	70.13	8.26	1.97	14.016
4	Georges Cr.	" "	Md.	B&O & PRR	" " "	199	3,04	18.45	70.07	8.44	1.02	13.920
5	Broad Top	" "	Penn.	P. R. R.	" " "	84	0.71	15.84	72.95	10.50	1.78	13.915
6	Somerset Co.	" "	"	B&O & PRR	" " "	224	2.54	17.51	70.54	9.41	1.13	13.870
7	Pittsburg	Bituminous	"	B&O & PRR	" " "	16	2.75	33.91	56.28	7.06	1.28	13.864
8	Fairmont	"	W. Va.	B & O	" " "	17	2.48	36.35	55.360	7.57	1.99	13.813
9	Kanawha	"	"	C&O & and Vgn.	" " "	34	3.49	32.30	57.40	6.72	1.12	13.809
10	Indiana Co.	"	Penn.	PRR & NYCRR	" " "	45	1.58	21.68	65.08	10.66	2.03	13.787
11	Clearfield	Semi-Bitum'ous	"	PRR & NYCRR	" " "	185	2.41	20.47	67.50	9.62	2.02	13.779
12	Clinch Valley	Bituminous	Va.	Clinchfield & N&W	" " "	24	4.27	32.30	57.21	6.22	1.04	13.755
13	Jefferson Co.	"	Penn.	PRR & BR&P	" " "	44	1.54	30.35	58.55	9.56	2.22	13.661
14	Upper Potomac	Semi-Bitum'ous	M. & W.V	B&O & WMdRR	" " "	116	2.74	20.07	67.07	10.12	1.06	13.659
15	Tioga Co.	" "	Penn.	Erie & NYCRR	" " "	6	1.74	19.68	67.09	11.49	1.93	13.599
16	E. Westmoreland County.	Bituminous	"	P. R. R.	" " "	24	3.25	31.08	55.22	10.45	1.64	13.390
17	Tennessee	"	Tenn.	----------	U. S. Govt. Test	5	5.45	33.84	51.85	8.76	1.55	12.866
18	Alabama	"	Ala.	----------	" " "	4	4.74	27.30	55.63	12.51	0.91	12.709
19	Anthracite	Screenings	Penn.	----------	Boston Cha.Com.	57	3.87	5.61	78.26	12.26	0.82	12.671
20	Anthracite	Buckwheat	"	----------	" " "	148	3.83	4.86	74.54	16.77	0.84	11.771

FIG. 1. ANALYSES AND CALORIFIC VALUES OF WELL KNOWN EASTERN COALS.

table of representative analyses which will be useful in comparing the different coals enumerated therein. This table embraces practically all of the coals which are offered to the Eastern and Southern cotton mill trade, and is based on the most reliable data available, the sources of which are shown.

We found in the early part of our discussion that semi-bituminous coal was especially well adapted to boiler use. Typical examples of this coal are those known as New River and Pocahontas. Typical examples of bituminous coal are those known as Clinch Valley, Kanawha, Pittsburg and the coals of Tennessee and Alabama. There is a vast difference in the economy of different coals, although not such a great difference in the price at the mines. A purchaser would do well to think twice before buying a poor coal because of the low mine price, for as you all know, the quotation on coal to the consumer is its price at the mine plus the freight to the consumer's mill, but the freight may have the effect of cancelling any saving due to low first cost, as will be seen presently.

To illustrate the fallacy of buying poor coal at a low price F.O.B. mines, I quote below from a report of the Boston Chamber of Commerce, which body recently appointed a committee to investigate the fuel supply of New England. Their report states:

"The importance of the relation between the cost of transportation and the quality of coal can not be too strongly emphasized, as when a sufficiently high freight rate is paid, the better the coal the more economical it is. The relation between the quality of two coals remains constant regardless of price or freight, while the delivered prices grow proportionately closer as the freight becomes greater.

Now coming to the question of dealers, but few words are required to convince one of the value of a strong and trustworthy connection. Strikes, affecting both railroads and mines, come at the most inopportune time, and very often without warning, prices soar or coal may not be found on the open market at any price. At such a time a shipper with large resources will stand the best show of taking care of his regular customers. Even under normal conditions, a one or two-mine concern may have an explosion or fire which will tie up its output for an indefinite period. There are steam coals to be found on the market represented by private brands or trade-marks, which have a long-established reputation, built up on the superior quality of the coal. These trade-marks are naturally a highly valued asset, represent an enormous investment and prove to be a guarantee of good faith, to the consumer, as their continuance in popular favor is dependent upon maintaining the high standard of quality for which any particular trade-mark is famed. Consequently, the use of such a coal has many advantages which can not be reduced to a matter of mere figures.

Last year Lewis W. Parker gave the sum of $1,000 to the South Carolina Department of Agriculture to be used in encouraging the growth of long staple cotton. An additional $1,000 was given by the Cotton Manufacturers' Association. This sum is expended by Ira W. Williams of the the United States office on farm demonstration work in that State

APPROXIMATE COST OF MILL BUILDINGS.

BY CHARLES T. MAIN.

It is sometimes convenient to be able to tell off-hand the approximate cost of proposed buildings, or the cost if new, of existing buildings without going through an estimate of all the quantities of materials and labor. It is not an uncommon thing to hear some persons place the cost of mill buildings from seventy cents to a dollar per square foot of floor space, regardless of the size or number of stories. There is, however, a wide range of cost per square foot of floor space, depending upon the width, length, height of stories and number of stories.

Sometime ago, I placed a valuation upon a portion of the property of a corporation, including some 400 or 500 buildings. In order to have a standard of cost from which to start in each case, I prepared a series of diagrams showing the approximate costs of buildings varying in length and width and from one story to six stories in height. The height of stories also was varied for different widths, being assumed 13 feet high if 25 feet wide, 14 feet if 50 feet wide, 15 feet for 75 feet, 16 feet for 100 feet and over.

The costs used in making up the accompanying diagrams are based largely upon the actual cost of work done under average conditions of cost of materials and labor and with average soil for foundations. The costs given include plumbing, but no heating, sprinklers, or lighting. These three latter items would add roughly ten cents per square foot of floor area.

USE OF DIAGRAMS.

1. The diagrams can be used to determine the probable approximate cost of proposed brick buildings of the type known as "slow-burning" to be used for manufacturing purposes with total floor load of about 75 pounds per square foot, and these can be taken from the diagrams readily. For example, if it is desired to know the probable cost of a mill 400 feet long by 100 feet wide by 3 stories high, refer to the diagram showing the cost of three-story buildings. On the curve for buildings 100 feet wide, find the point where the vertical line of 400 feet in length cuts the curve, then move horizontally along this line to the left-hand vertical line, on which will be found the cost of 81 cents.

The cost given is for brick manufacturing buildings under average conditions and can be modified if necessary for the following conditions:

(a) If the soil is poor or the conditions of the site are such as to require more than the ordinary amount of foundations, the cost will be increased.

(b) If the end or a side of the building is formed by another building, the cost of one or the other will be reduced slightly.

(c) If the building is to be used for ordinary storage purposes with low stories and no top floors, the cost will be decreased about 10 per cent. for large low buildings, to 25 per cent. for small high ones; about 20 per cent. usually being fair.

(d) If the buildings are to be used for manufacturing purposes and are to be substantially built of wood, the cost will be decreased about 6 per cent. for large one-story buildings, to 33 per cent. for high small buildings, and 15 per cent. would usually be fair.

(e) If the buildings are to be used for storage with

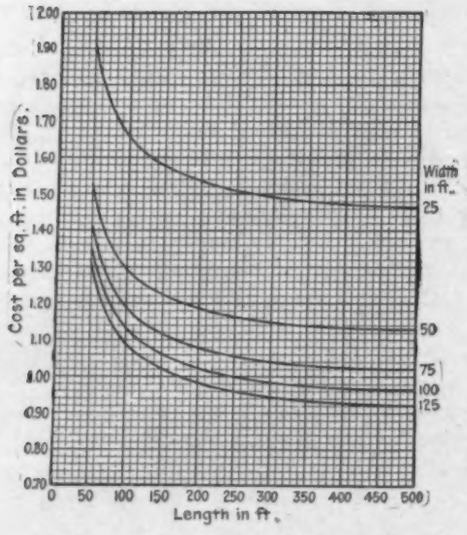


DIAGRAM FOR ONE-STORY BUILDING.

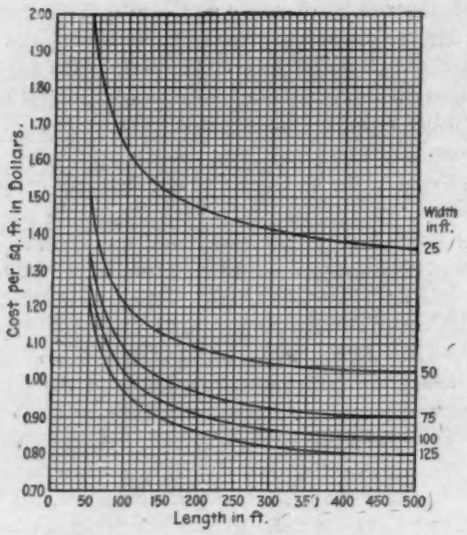


DIAGRAM FOR TWO-STORY BUILDING.

ESTIMATED COST PER SQUARE FOOT OF GROSS FLOOR AREA OF BRICK BUILDING FOR TEXTILE MANUFACTURING, INCLUDING FOUNDATIONS AND PLUMBING.

low stories and built substantially of wood, the cost will be decreased from 13 per cent. for large one-story buildings, to fifty per cent. for small high buildings, and 30 per cent. would usually be fair.

(f) If the total floor loads are more than 75 pounds per square foot the cost is increased.

The cost of very light wooden structures is much less than the above figures would give. Table 1 shows the approximate ratio of the costs of different kinds of buildings to the cost of those shown by the curves.

2. The diagrams can be used as a basis of valuation of different buildings. A building, no matter how built nor how expensive it was to build, can not be of any more value for the purpose to which it is put than a modern building properly designed for that particular purpose. The cost of such a modern building is then the limit of value of existing buildings.

Existing buildings are usually of less value than new modern buildings, for the reason that there has been some depreciation due to age, and that the buildings are not as well suited to the business as a modern building would be. Starting with the diagrams as a base, the value can be approximately determined by making the proper deductions.

Superficial feet of Floor in one story	Frame Mills Height in Stories						Brick Store House Height in Stories						Frame Store House Height in Stories					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1,250	.86	.67	---	---	---	---	.80	.73	---	---	---	---	.70	.51	---	---	---	---
2,500	.86	.73	---	---	---	---	.85	.73	---	---	---	---	.75	.58	---	---	---	---
5,000	.89	.78	.75	.73	.70	.67	.83	.80	.78	.76	.76	.75	.74	.60	.56	.53	.51	.48
7,500	.90	.79	.77	.74	.71	.69	.85	.81	.78	.77	.76	.76	.77	.63	.58	.55	.53	.51
10,000	.90	.80	.78	.75	.73	.70	.87	.81	.79	.78	.77	.76	.78	.65	.60	.57	.55	.53
15,000	.91	.82	.79	.77	.75	.72	.89	.83	.81	.79	.78	.78	.81	.67	.64	.61	.59	.56
20,000	.92	.83	.81	.79	.77	.74	.90	.84	.82	.80	.80	.79	.82	.70	.67	.64	.61	.59
25,000	.92	.85	.82	.80	.78	.76	.91	.85	.83	.82	.81	.80	.83	.72	.69	.66	.63	.61
30,000	.93	.86	.84	.81	.80	.77	.91	.86	.84	.82	.81	.81	.84	.73	.70	.67	.65	.62
35,000	.93	.87	.84	.82	.80	.78	.92	.86	.84	.83	.82	.81	.85	.74	.71	.68	.66	.63
40,000	.93	.87	.85	.86	.81	.79	.92	.87	.85	.84	.83	.82	.86	.75	.72	.69	.67	.64
45,000	.94	.87	.85	.83	.82	.79	.92	.87	.85	.84	.83	.82	.86	.76	.72	.70	.67	.65
50,000	.94	.88	.86	.84	.82	.80	.92	.88	.86	.84	.83	.83	.87	.77	.73	.71	.69	.66

TABLE 1.—RATIO OF COST OF BUILDING DESIGNATED, COMPARED WITH BRICK MILLS OF STANDARD CONSTRUCTION.

3. The diagrams can be used as a basis for insurance valuations after deducting about 5 per cent. for large buildings to 15 per cent. for small ones for the cost of foundations, as it is not customary to include the foundations in the insurable value.

BASIS OF ESTIMATES.

Table Number 2 shows the costs which form the basis of the estimates, and these unit prices can be used to compute the cost of any building not covered by the diagrams. The cost of brick walls is based on 22 bricks per cubic foot, costing $18 per thousand laid. Openings are estimated at 40 cents per square foot, including windows, doors and sills.

Ordinary mill floors, including timbers, planking and top floor with Southern pine timber at $40 per thousand feet board measure and spruce planking at $30 per thousand, costs about 32 cents per square foot, which has been used as a unit price.

Ordinary mill roofs covered with tar and gravel, with lumber at the above prices, cost about 25 cents per square foot, and this has been used in the estimates. Add for stairways, elevator wells, plumbing, partitions and special work.

DEDUCTIONS FROM DIAGRAMS.

1. An examination of the diagrams shows immediately the decrease in cost as the width is increased. This is due to the fact that the cost of the walls and outside foundations, which is an important item of cost, relative to the total cost, is decreased as the width increases, For example, supposing a three-story building is desired with 30,000 square feet on each floor:

HEIGHT IN STORIES	FOUNDATIONS including excavations Cost per lin. ft.		BRICK WALLS Cost per sq. ft. of surface		Columns in including piers and castings
	for outside walls	for inside walls	outside walls	inside walls	Cost of one
1	$2.00	$1.75	$ .40	$. 40	$15.00
2	2.90	2.25	.44	.40	15.00
3	3.80	2.80	.47	.40	15.00
4	4.70	3.40	.50	.43	15.00
5	5.60	3.90	.53	.45	15.00
6	6.50	4.50	.57	.47	15.00

TABLE 2.—PRICES USED FOR ESTIMATING BUILDING COSTS.

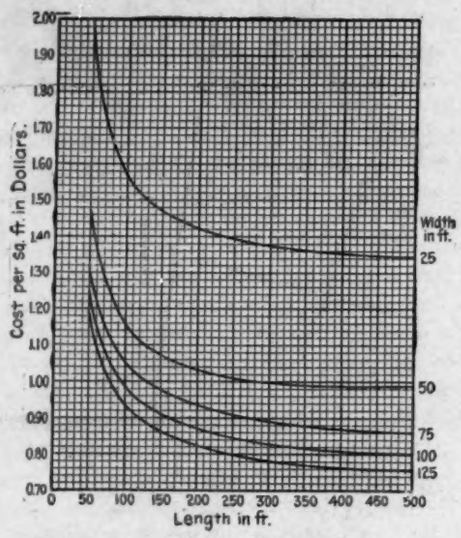


DIAGRAM FOR THREE-STORY BUILDING.

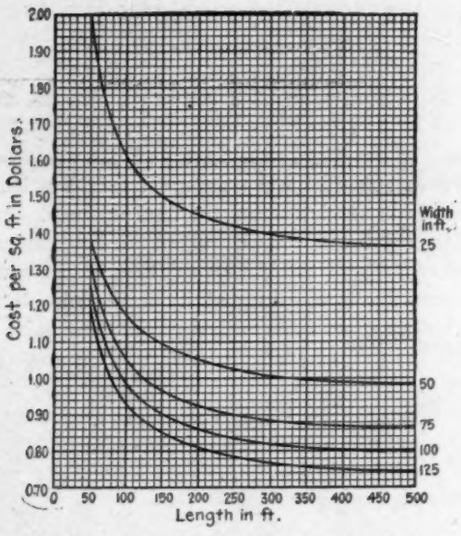


DIAGRAM FOR FOUR-STORY BUILDING.

Estimated Cost Per Square Foot of Gross Floor Area of Brick Buildings for Textile Manufacturing, Including Foundations and Plumbing.

If the building were 600 x 50 feet, its cost would be about 99 cents a square foot. If the building were 400 x 75 feet, its cost would be about 87 cents a square foot. If the building were 300 x 100 feet, its cost would be about 83 cents a square foot. If the building were 240 x 125 feet, its cost would be about 80 cents a square foot.

2. The diagrams show that the minimum cost per square foot is reached with a four-story building. A three-story building costs a trifle more than a four-story. A one-story building is the most expensive. This is due to a combination of several features:

(a) The cost of ordinary foundations does not increase in proportion to the number of stories, and therefore their cost is less per square foot as the number of stories is increased, at least up to the limit of the diagram.

(b) The roof is the same for a one-story building as for one of any other number of stories, and therefore its cost relative to the total cost grows less as the number of stories increases.

(c) The cost of columns, including the supporting piers and castings, does not vary much per story as the stories are added.

(d) As the number of stories increases, the cost of the walls, owing to increased thickness, increases in a greater ratio than the number of stories, and this item is the one which in the four-story building offsets the saving in foundations and roof.

3. The saving by the use of frame construction for walls instead of brick is not as great as many persons think. The only saving is in somewhat lighter foundations and in the outside surfaces of the building. The floor, columns, and roof must be the same strength and construction in any case.

REINFORCED CONCRETE BUILDINGS.

From such estimates and proposals as I have been able to get and from work done, it appears that the cost of reinforced concrete buildings designed to carry floor loads of 100 pounds per square foot or less would cost about 25 per cent. more than the slow-burning type of mill construction.

METHOD OF ESTIMATING.

Assumed height of stories: From ground to first floor 3 feet; buildings 25 feet wide, stories 13 feet high; buildings 50 feet wide, stories 14 feet high; buildings 75 feet wide, stories 15 feet high; buildings 100 feet wide, stories 16 feet high; buildings 125 feet wide, stories 16 feet high.

Costs for foundations, brick walls and columns are given in Table 2.

Floors, 32 cents per square foot of gross floor space not including columns. If columns are included, 38 cents.

Roof, 25 cents per square foot, not including columns. If columns are included, 30 cents. Roof to project 18 inches all around buildings.

Stairways, including partitions, $100 each flight. Allow two stairways, and one elevator tower for buildings up to 150 feet long. Allow two stairways and two elevator towers for buildings up to 300 feet long. In buildings over two stories, allow three stairways and three elevator towers for buildings over 300 feet long.

In buildings over two stories, plumbing $75 for each fixture including piping and partitions. Allow 2 fixtures on each floor up to 5,000 square feet of floor space and add one fixture for each additional 5,000 square feet of floor or fraction thereof.

NOTE: From the above data the approximate cost of any size and shape of building can be estimated in a few minutes. After the cost of the items given is determined about 10 per cent. should be added for incidentals.

Many analyses of cotton seed indicate that it contains about 10.3 per cent. of water, 3.5 per cent. of ash, 18.4 per cent. of protein, 23.2 per cent. of crude fibre, 24.7 per cent. of nitrogen free extract, and 19.9 per cent. of ether extract or oil. In other words, in 100 pounds of cotton seed there are the various percentages of the several materials enumerated. As will be seen, nearly 20 per cent. of cotton consists of oil, which when properly expressed and refined constitutes one of its most valuable products.

THE NATURE AND CAUSE OF WASTE FIBRE IN THE MILLS.

BY PROF. R. J. H. DELOACH, A. M., ATHENS, GA.

There was a time in the history of the manufacture of fabric from raw fibre when the great consideration was to get some kind of cloth from the fibre at hand. But be it said to the credit of the ancient art of hand weaving that less waste was incurred then than now, that is less waste fibre. There was far more waste of human energy, but before human society was as completely organized as it is now, channels for the use of human energy were much more restricted than now and hence what difference did it make if primitive people did spend weeks and sometimes months making enough cloth to hide their nakedness.

We are living to-day in a new era of a new world and not more strikingly so in any other industry than in the cotton industry of the United States. Therefore we must show all signs of progress and development, and our modern mills must turn out each day many yards of fabric per employee in order for us to make clothes for the world. Cotton cloths are finding their way into a great many lines of industry and new demands are being made for them every year, all of which seems to point out clearly the need of larger cotton fields and higher yields per acre.

The question of waste then is never an untimely subject in an industry that is assuming such proportions. When fibre was made slowly into yarn by hand among the ancients, there was very little loss because reasons for loss could be so easily guarded against. The mills have no choice in the selection of fibres nor in overcoming weak places in yarns. By hand eleven pounds of lint cotton made ten and three-quarter pounds of yarn. In the modern mill, eleven pounds of lint make ten pounds of yarn. The great saving comes then in the great rapidity of machine manufacture.

Waste may be divided into five classes: Trash, sand, diseased fibre and motes, broken fibres, good fibres lost through the imperfection of the mill machinery.

The first two will not be discussed in the present paper, as they might be considered problems for the cotton farmer rather than for the mills.

Cotton will average about one hundred thousand bolls to the bale of short staple upland, and it is safe to say that out of this number at least ten thousand bolls are diseased, defective and colored to some extent. The diseased bolls are much lighter in weight than those not diseased. Therefore instead of having a loss of ten per cent. in weight we have in fact a loss of only about four per cent. This seeming inconsistency is made clear upon a consideration of the fact that most of the diseased bolls have only one lock or two locks diseased, and all diseased cotton is known to have lost much of its weight.

Another source of considerable waste is that of motes or undeveloped seed. These immature seeds always have small quantities of very inferior fibre attached to them, which is not fit to be woven into fabrics. Upon a careful count of motes in a given number of bolls of cotton in sixteen counties in the State of Georgia, it has been found that medium cotton averages one of these motes to the lock, or about four hundred and fifty thousand to the bale. Experiments in cotton breeding by careful selection show the possibility of eliminating waste from this source. The number of motes was reduced to less than a hundred thousand to the bale in three years. The motes cause a considerable loss in drawing from the bulk of the fibre many good fibres that would otherwise go into fabrics. The mills are unable to separate these from the good fibre as a small per cent. of it will go out with the motes both in the picker room and in the carding room.

With these ten thousand colored and defective spots and four hundred thousand motes to the bale, a sample always grades from one to two grades lower than the same cotton without them. Several bales where separation of good from bad bolls was made, brought one cent to one and one-fourth cents per pound more on the market. This would show a gain of five dollars on a five hundred pound bale of cotton, by careful picking. At the same time we have lost four and a half per cent. by weight or 22½ pounds at 12 cents amounts to $2.70. But this defective cotton brought six cents per pound at the waste mills. So the net loss was only $1.35 on the poor fibre. Taking this from the $5.00 gain we would have a net gain per bale of $3.65. This gain on ten million bales would be a revenue of about thirty-six and a half million dollars annually to the cotton belt of the United States, without having to make another pound of cotton.

This is a very important matter because the carefully gathered cotton is actually worth to the mills this difference intrinsically, and the machinery made a far more uniform grade of cloth from it than from the cotton that has been carelessly gathered, for at best, much of the poor fibre left in the cotton by the picker will go into the cloth. The experiments along this line warrant us in predicting that mills will be able to run with little more than half the labor force if they can get carefully picked cotton to supply them. There will be far less breaking of yarns, and one employee can operate almost twice as many spindles as at the present time and under the present conditions.

The source of broken fibre before it reaches the mills is mostly from ginning and compressing. The rapid running of the gin is very costly to the cotton industry, as it is estimated that about three per cent. of the fibre is broken in this way, and a much larger percentage in exceptional cases especially where the cotton is damp or picked a little early. Not a great deal of study has been given to the effect of compression on the fibre, but some figures are at hand for our consideration.

A mill in Greenville, S. C., pays the railroad a premium of 50 cents per bale not to compress the cotton hauled to them, which it is the privilege of the railroad to do, claiming that it pays the mill to offer this premium in preference to having the cotton compressed. How does it pay? The mill finds that there is a fraction greater loss incurred in the manufacture of goods from the compressed cotton, and they find further that the compressed cotton is a fraction more difficult to make into yarn than the non-compressed cotton. It is a generally conceded fact that the sudden and heavy blasts of air caused by forcing the air out of the farmer's bale by the act of compression breaks the fibre to some extent.

Just to what extent the fibres are broken by the machinery in the mills themselves is a hard problem, as it has been impossible to tell which of the waste fibre was broken in the mills and which entered the mills already broken. Since the great bulk of loss is incurred in the picker room and in the carding room, and since the processes in these

rooms occasion the more irregular strain on the fibres, it is evident that the greatest damage done by the mills is done in these rooms. We would not overlook, however, the loss in all the other processes of the mills. Even up to the sizing of the yarn and in the spinning rooms we find relative percentage of loss, due largely to the working out of broken and inferior fibres.

This great bulk of waste is certain to be a factor in the cotton industry of the world for a good many years to come, and it seems that we should prepare to deal with it in the best possible way. Therefore, I believe that the following facts and figures will have a special meaning to the members of this great association. If we grant that, well trained labor will become available, all large cotton mills and associated mills should have a connection with the artificial silk mills to divert this waste into paying channels. There is considerable demand for this material in all parts of the world, and no raw material is equal to cotton fibre for making cellulose—the basis of artificial silk. In fact as we know it is almost pure cellulose to begin with, and can be made into solution at a minimum cost for the spinning of the silky fibres. I have not been able up to the present time to find the cost of installing machinery for this work, but from the following figures, I am persuaded of the importance of looking into this method of using waste fibre.

While artificial silk is being made at this time in the United States in very small quantities, it is reported that the largest plant in the world is about to be constructed at Chester, Pa. Germany and England are producing the best artificial silk yarns, France having fallen behind in this respect. The German yarns are made by the viscose process. While the total American consumption of artificial silk is 1,450,000 pounds, 880,000 pounds of this comes from France, Germany, and Italy.

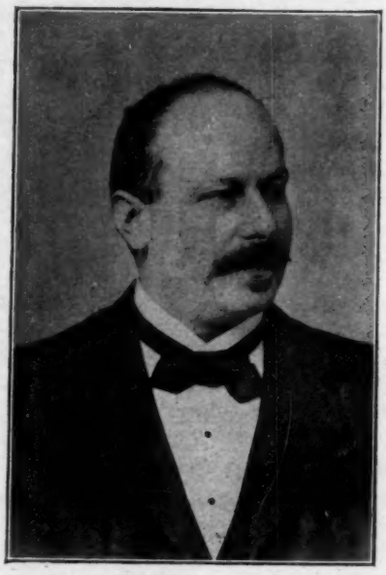
Another question of vital interest to the mills and growers jointly is: How can the great importance of properly caring for cotton be impressed on the minds of the growers? In this respect there seems to have been no improvement since cotton was first cultivated commercially. Attention is called to the fact that the packing of cotton in round bags by tramping, which prevailed from 1780 to 1810, was in the latter year replaced by the screw packed, square bale. Since this time, practically no changes have been made excepting the substitution of iron bands for ropes, and the introduction of the steam compress.

We are trying to point out the necessity for permanent improvement along this line to the farmers in the State of Georgia, and we feel that our efforts are bound to bring forth fruit within the next few years; but we must have the co-operation of the mills in order to make our work effective. They must be willing to make good just what we save to them. Could we not formulate some plan by which every lot of cotton of 100 bales or less would be worth a premium on the markets, if the proper attention has been given to it during the breeding and the picking season? This would be the means of putting every farmer on his own merit, as well as it would be the means of bringing to the mills the best possible grade of cotton.

The business of manufacturing goods, says S. A. Ashe, cannot be expanded unless we can secure markets in countries that do not manufacture these goods.

OBITUARY.

In the death of Isidor Wolf, senior member of W. Wolf & Sons, the textile industry loses one whose entire life was devoted to the business established by his father. During his life he became one of the best judges of the staples used in the cotton and wool manufacturing business, and at the



THE LATE ISADOR WOLF, STUTTGART, GERMANY.

time of his practical retirement some five years ago was the financial manager of their world-wide business. In 1898 Mr. Wolf spent six months in the United States, where their business has continually increased. At this time Julius Wolf, his son, is just completing a year in this country acquiring an education in American business methods.

Isador Wolf died at his home in Stuttgart, Germany, after a short illness, September 11, 1910.

Weights and Values in the Cotton Trade.

Proposals for the adoption of a new system of expressing weights and values in the cotton trade have been submitted to the cotton manufacturers in Great Britain by the British Weights and Measures' Association. Consul Grahame, at Bradford, reports that it is estimated that the proposed reform will save nearly $100,000 to the trade.

The new system would mean that all spinners, manufacturers, yarn agents and cotton goods merchants would express all fractions in hundredths when quoting, tendering or contracting for cotton goods of all descriptions. As regards weights, it is proposed that the 112-pound hundred-weight should be practically abolished in connection with the cotton trade. This change has already been put into effect, it is stated, in the weighing of cotton bales in Liverpool, and has resulted in a large saving.

The great damage caused by the bad weather in Middle Japan has struck a blow at the cotton printing trade in Tokio. While 1,026,000 pieces were printed last year (an average of 85,500 pieces per month), the number printed this year is almost 20 per cent. less. This falling-off, however, only applies to Tokio, as in Osaka there is a large surplus.

Mill Conditions and Market Reviews.

SOUTHERN MILL SITUATION.

(Special Correspondence.)

Concerning curtailment of production, there has been very little change in Southern textile circles last month from that obtaining during July, August and September, unless it was that mills were more persistent in short time work. By agreement, the Southern Soft Yarn Spinners' Association, which represents practically all the soft yarn mills of the South, followed during the first half of October a general policy of 50 per cent. curtailment. Whether this policy will be continued during November has not been officially stated, but it may be taken for granted that mills will hardly go back at once to regular full time work in the face of the present condition of the markets.

The situation affecting the hard yarn-mills is not greatly different from that in soft yarn circles. T. W. Crews, secretary of the Southern Hand Yarn Spinners' Association, states that he sees no other course for mills to pursue than to shut down a large part of the time, or run only a part of their machinery in view of the fact that prices offered for goods are from one to three cents below the cost of production. Hard yarn mills curtailed during last month at least 50 per cent., and not a few were forced to close down for indefinite periods. The cloth mills have likewise curtailed sharply. It is safe to say that only about half the spindleage of the South was active during last month with prospects of continued short time work.

The manufacturers of South Carolina, representing about 3,000,000 spindles or more, by agreement, shut down their plants entirely one week during last month, and it is likely they will shortly meet and decide upon a similar course for November unless conditions brighten. There are many spinners who believe that the bottom has been reached, and that, with the price of the new crop fixed, and the accumulated stocks greatly reduced by short time operation, the markets are bound to pick up shortly, and it is believed that once improvement sets in, the demand for goods will steadily increase, forcing the list of prices up to a point offering a profit to manufacturers. With a short crop following a short crop, it is argued that the world will need all the goods the mills can make, and that at a good price; and that the general law of trade will soon rectify the situation. This is all by way of forecast, however, and is poor solace to the manufacturer, who finds his help being disorganized by reason of only partial work, and he is forced to gaze upon schedules of quotations which offer him no margin of profit whatsoever on goods made.

In other branches of the trade, however, the outlook is more encouraging. Despite the unfavorableness of market conditions, capitalists appear to have an abiding faith in the future of the industry and are putting money into new mills and improvements with great confidence.

R. M. Miller, Jr., former president of the American Cotton Manufacturers' Association, and C. B. Bryant, present secretary of that Association, are strongly in favor of a joint annual meeting of the American Cotton Manufacturers Association and the National Association of Cotton Manufacturers, and are agitating the idea. Many well known mill men have recently expressed their hearty approval of the proposition. The suggestion is that the two associations hold their regular meetings, to be devoted to business strictly in the Spring, as is the case at present, and that the two bodies join together in an annual fall meeting, when the social features will be made prominent.

One prominent spinner in speaking of the plan, said "I am heartily in favor of the joint fall meeting idea. Two thousand cotton manufacturers, representing milling interests North and South, could get together once a year with decided benefit to all parties concerned. I for one should like to discuss matters pertaining to the industry with New England spinners. I believe that they can tell us things that we are not so well posted on, and, in turn, I believe that we can show the Northern spinners some things about the business about which we are better informed than they. The social feature, too, will be distinctly pleasing, and will nurture a more kindly feeling between the milling interests of the two sections. In other lines of trade there are national associations, representing all sections."

The joint meeting of the boards of governors of the two Associations in New York at the latter part of the month was so pleasant, that it is said the affair will be repeated sometime in December or January. There is general satisfaction over the selection of W. A. Erwin, of Durham, N. C., as chairman of the board of governors of the American Association, and members of the Association are looking forward to the May meeting of the Association in Richmond with much interest. Perhaps the most important phase of the joint meeting of officials of the two Associations was the agreement reached by the two committees on the uniform sales note. Lewis W. Parker, of the American Association, who, at the last meeting of that body, acting as chairman of the sales note committee, made an elaborate report on the subject, presented the completed form of contract at the New York meeting. It was adopted, and thus a matter which has agitated the trade for two years finds a solution. Mr. Parker is empowered to make certain minor changes suggested.

The form and provisions of the sales note were published in the October issue of COTTON on page 601.

The personnel of the two committees is as follows:

AMERICAN ASSOCIATION: Lewis W. Parker, chairman; D. Y. Cooper, Caesar Cone, W. E. Beattie, Ridley Watts, T. A. Blythe, L. Paulson, C. B. Amory, Arthur H. Lowe, D. L. Wainwright, J. P. Eddy, S. B. Tanner, R. M. Miller, Jr., the latter chairman of the yarn department.

NATIONAL ASSOCIATION: Albert F. Bemis, F. A. Flather, D. M. Bates, S. P. Bremer, John Eccles, A. M. Goodale, E. F. Greene, G. H. Hills, F. B. Macy, J. R. MacColl and L. W. Parker.

The Southern Textile Association is scheduled to meet in Charlotte, N. C., on Saturday, November 26th and the committee in charge of entertainment, as well as the program committee, are busy making arrangements for the best meeting yet held by this organization. It will be recalled that the last meeting, which was largely attended, was held in Augusta, Ga. About 350 delegates were pres-

ent. The Association is composed of superintendents, master mechanics, and overseers, and a large number of mill owners will attend the coming Charlotte meeting. The fact that there are 400 cotton mills within a radius of 100 miles of Charlotte indicates that the attendance will be the largest in its history. Although the program committee is not ready to report, it is stated that there will be numerous ably prepared papers and addresses on subjects of vital interest to the trade.

NEW ENGLAND MILL SITUATION.

(Special Correspondence.)

Soon after October opened it became apparent that low priced cotton was not to be a feature of this year at least, and mill agents in New England and their selling representatives in New York began shaping merchandising policies toward a higher plane of cloth values. The agents handling bleached cottons and staple ginghams, who had guaranteed prices to the first of the month, let it become known to buyers that there would be no reduction in those lines. Then came the cotton report which gave a warrant for sustained cotton costs. Buyers in the large jobbing houses and especially those in the large Western distributing centers, concluded that lower prices would not come, and they began to operate in a quiet way. About the 10th of the month it became known that the stocks of leading tickets in bleached goods had been bespoken and that some of the large commission houses were selling goods freely. Prices began to rise and the buying became general.

For a time, agents would sell only the stocks in hand; but orders began accumulating and mills began to contract for 60 and 90 days ahead at increasing prices. The largest movement was in goods of print cloth yarn construction and slightly lower, but eventually the course of the market tended toward a general inquiry for most of the domestic staples. Converters and printers bought quite liberally, and the latter paid particular attention to many of the sub-counts. After the middle of the month the market became set toward a higher level, and while at the end of the month the purchasing was more restricted and careful, the trend was still toward a basis that will warrant continued production up to possibly 80 per cent. of full capacity. All tickings have been advanced to a level of 13½ cents for Amoskeag ACA's, and denims to a level of 14½ cents for Southern 9 oz. Cotton blankets were advanced by the 20th about 7½ per cent. for Nashua standards; and canton flannels, shrunks, drills, and sheetings went up from ¼ to ⅜ cent a yard, for some of the standards. At the last of the month the large jobbers appeared to have covered their wants for the next 60 days, but in the event of a normal demand for early spring shipments of staple merchandise the jobbers will be forced in again.

The uplift has not been so sharp in the finer count fabrics, or those above a basis of 50s warps. The carded yarn fine cloths have shown more strength than fine combed yarn goods and it is becoming a serious question whether the increased spindleage of the past two years is not affecting the power of profitable distribution. All of the gingham mills are well under order and are running in full with every prospect of continuous operation through the winter. The Fall River mills have sold in excess of the production for the past four weeks and are engaged ahead for the balance of the year for about one-half of a full output. The stocks of print cloths on hand at that center, including all constructions, do not exceed a million pieces, or hardly a month's output. New Bedford mills are engaged ahead on an average for three-fourths of a full output to February 1, but there are still many plain looms that are not running. The printing and bleaching establishments are moderately busy, some of them being rushed for immediate delivery business and others operating only a portion of the machinery. The great bulk of the business in hand is for delivery by the end of the year or early next year, so that much is yet to be accomplished before agents see any guarantee of prolonged employment. The improvement has been gradual, and orders have been booked to get mills in operation rather than with the thought that prices will show a profit continuously this season, based on cotton above 13 cents.

In commission house circles where New England goods are handled the thought is expressed that the country's purchasing power is hampered still, and until the crops are gathered and the election uncertainties and agitations are out of the way, and possibly the bank restrictions due to general financial matters, are removed, the best that can be hoped for is a moderate demand that will care for a part of a spring production at a very close margin of profit. That prices will go higher than they now are is confidently believed, for it appears to most selling agents as if jobbing stocks are not large enough for a sustained business and expectations are common that a further uplift will be noted during November. A similar view is held in some of the largest houses handling Southern cottons and particularly in those quarters where duck, and the heavier grades of domestics are sold.

The impression in the trade is that the New England mills will not undertake an agreed curtailment for some months. There is now and is likely to be for some little time yet, a number of idle looms and spindles. The recent trading indicates a willingness on the part of mills to contract through the first three months of the year for a limited portion of the output, but principally upon cloths which converters must order if they are to have them when the trade calls for them. The largest factors in bleached and brown cottons are stating plainly to buyers that mills will not accumulate stocks in any degree unless prices promise a return that will warrant the chance. The mills have been buying cotton moderately and have been paying above 14 cents for it, but agents say they will not cover in any large way until buyers place orders that will hold.

The annual mill meetings are now under way in New England. The returns show losses or moderate profits as compared with returns of a year ago. Dividends have been generally maintained, but the figures show that many of them were drawn from surplus accounts. The first six months of the fiscal year were generally profitable, and the last as a whole, showed losses. Coupled with the fact that cotton stocks are not large the memory of a hard six months is likely to influence manufacturers toward great caution in the acceptance of future business. So far as facts in hand indicate, the manufacturers in this section have more confidence that buyers will pay prices based on cotton above 13 cents and 14 cents than they had a year ago and there

is much less resentment showed by agents toward the status of affairs in the raw material.

The mill machinery manufacturers are not running in full, save in the case of the Whitin and American Machine Companies. Most of the others are running about 45 hours per week. The supply houses report an improving business. The mill stock market has given evidence of a wider confidence in shares, and advances are being noted weekly on small sales. The effort of treasurers to sustain dividends and their willingness to pay them from surplus accounts gives promise of a broader market after the annual mill meetings have been digested fully by investors.

One of the significant features of the month was the sale of the mill properties owned by the Arnold Print Works. A syndicate headed by William M. Butler, of Boston, and president of the Butler mills at New Bedford, bought the Eclispe and Beaver mills at North Adams, Mass., while the Messrs. Plunkett, owners of the Greylock mills, have purchased the North Pownal (Vt.) Mfg. Co., and the Williamstown mills. These latter are adapted to make print cloths and will be changed over to finer goods. The other mills will be managed by N. B. Kerr, of the Butler mills, and as he is one of the most expert of the New England fine goods men, it speaks well for the confidence felt in New England concerns.

Export markets have been quiet during the month. Sales of about 1,500 bales of 3.50 sheetings were made for the Chinese market and trading with Manila on prints and scattered lots of brown goods continued. Southern mills have sold moderate lots of South American goods and some small sales of duck have been made. Prospects of Chinese trade are not bright, owing to financial disturbances and other complications at Shanghai. A strong feature is that stocks are not cumbersome in China, and when the purchasing power broadens, there should be a fair chance of American goods getting in again. It is noted that Japan, Germany and England have suffered as this country is suffering in the matter of a limited demand for high cost cottons in the Far East. Representatives of the large Chinese houses here state that there is nothing to do but wait until conditions in China improve, and they are less inclined to blame high cotton than the causes indicated above for the slow trade to date.

MONTHLY COTTON MARKET REVIEW.

BY H. & B. BEER, NEW ORLEANS.

Weather conditions during the past month have been most favorable for the growing crop in all sections of the belt. There have been no serious storms to contend with, and, except in Oklahoma and at a point or two in the north-central portion of the belt, there has been no frost of consequence. Therefore, the outlook for the growing crop is decidedly more favorable than one month ago, and the fact that we entered the month of November before a general freeze was experienced in the South, is unusual.

There has been a fairly good demand for spot cotton, principally for account of New England, takings by the North thus far this season being larger than one year ago; 307,000 bales against 252,000 bales. However, Southern mills have taken only 315,000 bales to date compared with 359,000 one year ago, while European mills have not taken as much as last year by a big margin—757,000 compared with 934,000 bales; total takings by the world so far figuring 1,379,000 bales against 1,545,000 in 1909. The movement to market has been rather free, the "in sight" to the 21st of October totaling 2,792,000 bales compared with 3,102,000 last year, and is gradually picking up. It is probable that, owing to the crop promising to be much larger than one year ago, receipts will from now on be much heavier than one year ago during the balance of the season. The crop is not as small as generally reported, and some people would have it that this year's yield will be light as the outturn of the 1909 crop, which was the smallest yield per acre on record. Far from it; everything points to a much larger crop than last year; the last Bureau having indicated a crop of about 13,000,000 bales based upon results of a normal season and this year's record acreage of 33,000,000 acres.

There was issued on October 25th the third installment of reports by the U. S. Census Bureau on the quantity of cotton ginned to October 18th. The report shows 5,410,960 bales ginned to October 18th, compared with 5,530,967 bales to the coresponding date in 1909; 6,296,166 bales to the corresponding date in 1908; and 4,420,258 bales to the corresponding date in 1907. By reason of less cotton being ginned to October 18th than was ginned to same date one year ago, a bullish construction was placed upon the statement. But this crop is late, not small, which accounts for the poor showing when compared with returns of last year. The crop of 1909 was very early, made so by a general drouth in the South last summer and fall, also by record breaking forcing high temperatures, something which was not experienced this year. When comparison is made with recent years other than last year, the following deductions are arrived at. On the basis of 1908 ginnings to October 18th, the indicated crop is 12,940,000 bales, on the basis of ginnings to October 18th, 1907, the indicated yield is 12,563,000 bales, and on the basis of ginnings to October 18th in 1906, the indicated yield is 13,990,000 bales.

It will be argued that the boll weevil covers a larger area than in 1906, which is true, but it is also true that the acreage this year is larger than it was four years ago by 1,000,000 acres. As for Texas, it actually shows more cotton ginned to October 18th than was ginned to same date in 1908, when the State made 4,050,000 bales, ginnings this year having been 2,068,743 bales against 2,047,796 bales two years ago. The South Atlantic States are showing up better than expected, and while the Mississippi Valley States lag behind, owing to lateness of the crop, Oklahoma has come to the front with the heaviest ginnings on record to October 18th for that State, despite lateness of the season in that quarter. The Census report, showing cotton ginned to October 18th compared with last year by States is as follows: United States 5,410,960 vs. 5,530,967; Alabama, 523,051 vs. 512,323; Arkansas, 161,111 vs. 330,-884; Florida, 26,837 vs. 35,006; Georgia, 914,565 vs. 1,113,-341; Louisiana, 113,202 vs. 143,977; Mississippi, 334,561 vs. 390,096; North Carolina, 249,942 vs. 255,040; Oklahoma, 419,983 vs. 329,429; South Carolina, 513,512 vs. 624,301; Tennessee, 57,658 vs. 101,250; Texas, 2,068,743 vs. 1,675,428; all other States, 7,995 vs. 19,892.

THE YARN MARKET.

Decided improvement both in price and amount of business characterized the yarn market during the last month, and especially was this true during the third week. However, it cannot be said that conditions in the market were altogether satisfactory for the mills or the buyers, as in the former case, curtailment which was practically as drastic as had been in force for some time, continued, and on the other hand while buyers were making inquiries and in some cases placing very good orders, prices did not suit them altogether and they were loath to come into the market at the prices quoted by the spinners. The pessimistic feeling which permeated the market throughout the summer months seemed to have been dissipated, and the belief was general that prices of yarns are destined to advance to higher figures in a short time. This is due in a measure to the more confident feeling in general and to the belief that the price of raw cotton for the season will average at least 15 cents a pound.

In an advancing market, there is naturally more or less irregularity in quotations, and such was the case last month. The beginning of the month witnessed a great variation in prices from day to day, and it was a difficult matter to say just what was the true state of the market. Buyers who would refuse a spinner's quotation one day would find probably on the next that if he had concluded to meet the spinner's price, it was no longer acceptable to the spinner, who had advanced his quotations over night. The business put through was as a rule a compromise, which seemed to be the only method of really placing an order. The chief demand during the first part of the month was centered in yarns of special descriptions and particular counts for early delivery, and as a consequence the dealer who had these yarns in stock secured the business.

It was evident that spinners were determined to refuse business which did not show them some margin of profit based on 14 and 15 cent cotton which are the prices they have had to pay. This independent position of the spinners doubtless was an important factor in maintaining and advancing prices during the month, as the buyers realized that their position was strong and that to delay the matter of making the necessary purchases would be taking a risk that they did not wish to assume. It was true that some spinners accepted business at figures considerably below quotations of others. That short selling was practiced in some instances is believed, which if true, only served to strengthen the position of the spinners. Hosiery yarns received very little attention from buyers, as the prices named by the spinners were, as a rule, too high for their consideration, based on the current prices of their knitted product.

The hardening of the prices of raw cotton during the middle of the month only made the spinners more determined in their fight for higher prices, and brought the buyers to a realization of the fact that they could not expect to see lower prices in yarns in the immediate future at least, and having overstayed the market for some time, it was necessary for them to cover their contracts at the advanced prices. At that time quotations ranged from one to two cents a pound higher than the preceding month. It must be understood, however, that there was a diversity of opinion as regards the future of the market, and many buyers held off in the belief that the spinners who had been curtailing drastically would all begin operations at the same time and thus spoil, in a measure, the good work which they had done in keeping down production.

From all accounts it would seem that the knitters are in a rather delicate position, as it is understood they have sold contracts for their goods and have not bought sufficient yarn necessary in their production.

The market prices continued upwardly during the latter part of the month with a decided lessening in the demand as spinners' quotations, which were as a rule one-half to one cent above the ideas of buyers. While it was recognized that stock yarns were very scarce, yet a sufficient quantity was on hand for some of the dealers to distribute at slight concessions from the asking prices of the spinners. Hosiery yarns at the end of the month were quoted considerably higher than for some time, and spinners were maintaining their position very firmly. With cotton averaging 15 cents a pound, it is safe to predict that, with the demand which is sure to materialize sooner or later, prices of yarns will be materially advanced over quotations at the end of the month.

The following are the quotations at the end of October:

SOUTHERN SINGLE SKEINS

4s to 8s	21½@	22s	24 @
10s to 12s	21½@22	26s	25 @
14s to 16s	23 @23½	36s	26 @26½
20s	23½@24		

SOUTHERN TWO-PLY SKEINS.

4s to 8s	21½@22	30s	30 @31
10s to 12s	22 @22½	40s	31½@32½
14s	23 @	50s	35 @36
16s	23 @23½	60s	44 @45
20s	24 @24¼	3-ply 8s upholstery	22½@
24s	25 @25½		
26s	25½@26	4-ply 8s upholstery	22½@
30s	26 @26½		

SOUTHERN SINGLE CHAIN WARPS.

8s to 10s	21 @22	22s	24 @24½
12s	22 @22½	24s	25 @
14s	23 @	26s	26 @
16s	23½@	30s	26 @27
20s	22½@23	40s	32 @

SOUTHERN TWO-PLY CHAIN WARPS.

8s to 10s	22½@	26s	26 @
12s to 14s	22½@23	30s	26½@27
16s	23½@24	40s	32 @33
20s	24 @24½	50s	37 @37½
24s	25½@		

SOUTHERN PEELER FRAME CONES.

10s	22 @	20s	23½@24
11s	22¼@	22s	24 @24½
12s	22½@22¾	24s	24½@25
14s	23 @	26s	25 @25½
16s	23¼@	28s	25½@26
18s	23½@	30s	26½@

THE KNIT GOODS MARKET.

Notwithstanding the fact that improvements had set in during the month of September in the knit goods market in the way of higher prices and better demand, a review of the situation during the month of October indicates that conditions were not altogether satisfactory to knitters, especially in regard to prices. It has been argued for some time that prices on hosiery were too low compared with prices of raw cotton and yarns, and the main difficulty appeared to be the inability of knitters to advance prices commensurate with higher quotations in the primary mar-

ket. The demand for hosiery was apparent, but at prices that either showed a loss or an even break for the knitter, and consequently there was very little incentive for him to secure contracts on such a basis.

The beginning of the month found a very fair volume of duplicate business for fall goods, the New England section contributing the major portion of the business, this section having also been the leader in placing initial business on spring lines. The situation in the West, which was the bright spot in September, continued to offer encouragement to the trade by the cheerful outlook from that section and the business put through. Besides the business offered from these sections a very nice demand was in evidence for children's stockings and socks, and business put through on these lines during the first of the month greatly exceeded such demand for a long time. Knitters continued to complain of the poor prices, however, in these as well as other lines.

An interesting feature of the demand in general was the fact that the majority of jobbers placed their orders for immediate delivery, the volume of such business being considerably in excess of the usual quantity of spot deliveries. The continued demand for silk hosiery at popular prices has had an effect on 50-cent cotton hosiery, and some knitters are of the opinion that it is bad policy to popularize such a grade which must necessarily be inferior, and as some claim, practically worthless. There was some doubt of the ability of this grade to maintain its popularity through the winter, owing to the sheerness and unsuitableness for cold weather. Woolen socks have been in sufficient demand to stiffen prices, owing to the small stocks on hand. As regards spring business, fine lisles were the leaders and the prices on these finer grades were more in keeping with profitable business, as the yarns are not susceptible to the fluctuations as with the low count yarns. Fancy half hose was also in good demand, the styles being very attractive. The low grade fancy hosiery had less favorable attention, although business in this line was better than during the summer months.

Coupled with the lack of response to the efforts to advance the prices of hosiery was the fact that money was held very closely and jobbers were complaining that retailers were not making payments as promptly as they had expected, and therefore they could not make remittances to the knitters as promptly as might be desired. As a whole the market lacked a spirit of optimism and cheerfulness which often goes a long ways towards helping a bad situation. With the continued rise in the price in cotton and yarn it is reasonable to suppose that the prices in the knit goods market will respond in a measure to changed conditions.

COTTON MANUFACTURING.

VARIABLE SPEED RING SPINNING.

BY G. H. COOKE.

A ring frame may be said to be driven at continuously varying speed when the speed of the driving shaft, and therefore of the whole frame, is designedly and automatically varied from moment to moment throughout the spinning of each set of bobbins. The extent to which the speed of any frame can be varied depends on the tensions to which it subjects the yarn during spinning. It has long been understood and recognized that a ring frame used at a constant speed is by no means a perfect spinning machine, although it possesses advantages which are making it increasingly popular for the spinning of certain yarns. The floor space occupied by a ring spindle is small and its output is high compared with that of a mule, but it does not handle the yarn so gently or so uniformly as a mule does. That the tension on the yarn as it is being spun on a ring frame does vary, can easily be felt by hand—it can be felt to increase each time the rail rises, and to decrease each time it falls.

The reason why the tension on the yarn must vary with each rise and fall of the rail, if the speed is kept constant, is explained in Fig. 1, which shows a bobbin in plan. The smallest circle represents a bobbin, the middle one the full circumference of the bobbins, and the outer circle the path of the traveler round the ring. The traveler is assumed to be at A, at the extreme left-hand side. Its speed is practically constant (though actually it will be from one per cent. to two per cent. less when spinning on to the small diameter), so it always has to be dragged round against a constant frictional resistance represented by the line B C and a constant windage resistance represented by A B. To overcome these resistances the thread has to provide a constant pull represented by A D which is equal to the sum of the resistances A B and B C, and acts tangentially to the path of the traveler, that is, in the direction indicated by the arrow on the line A D. To produce this force A D the actual tension in the thread between the bobbin and the traveler has to be equal to a force represented by the line A E when spinning on to the full diameter of the cop, and has to increase to a force A F when spinning on to the bare bobbin each time the rail rises. Neither A B nor B C are really absolutely constant, but roughly speaking, the tensions on the thread between the bobbin and the

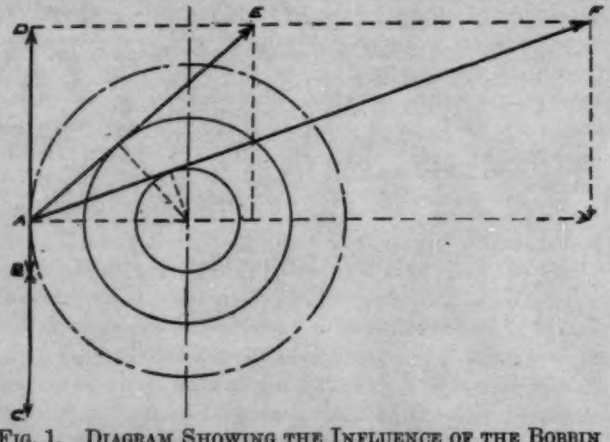


FIG. 1. DIAGRAM SHOWING THE INFLUENCE OF THE BOBBIN DIAMETER UPON THE PULL BETWEEN THE TRAVELER AND THE BOBBIN.

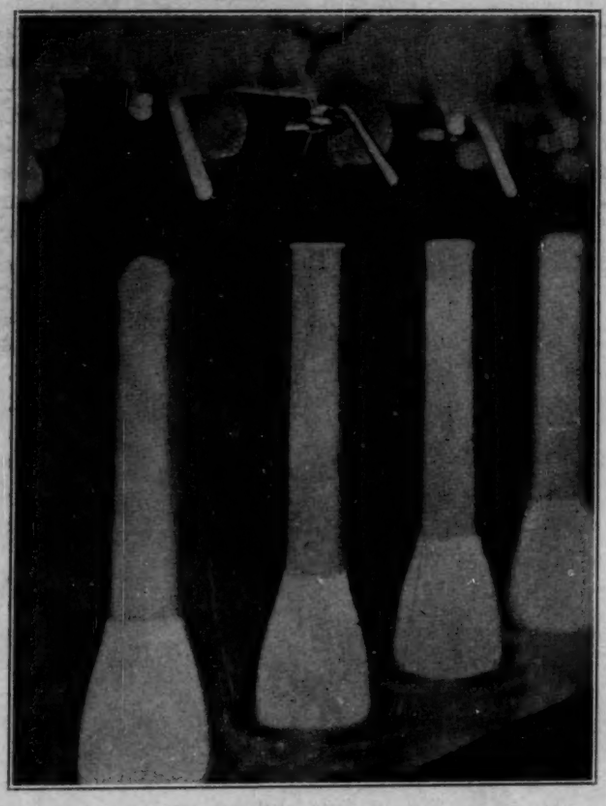


FIG. 2. SIZE OF BALLOON WHEN WINDING ON THE LARGEST DIAMETER OF THE BOBBIN.

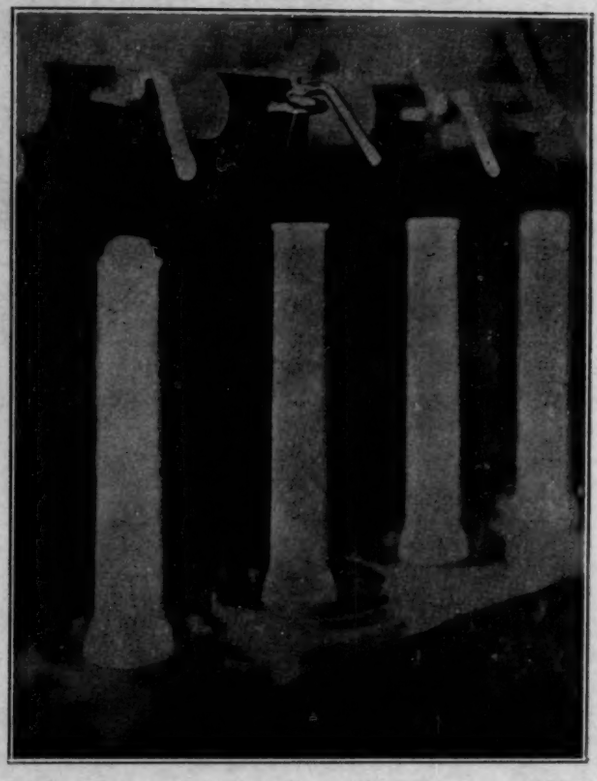


FIG. 3. SIZE OF BALLOON WHEN WINDING ON THE BARE BOBBIN.

traveler are inversely proportional to the diameter of bobbin spun on to. Furthermore it is well known that most breakages occur whilst the base and the top part of the cop are being formed, the breakages being least during the spinning of the middle portion. This, in a frame driven at constant speed, is unavoidable.

On any given frame which has to run continuously at one speed, the spinner can only control the tensions on the yarn by choosing suitable speeds and travelers, which have to be such that the ballooning is not excessive while spinning the bottom of the cop nor the tension of the yarn excessive while spinning the top. The speeds and travelers so chosen must always be in the nature of a compromise, because those which are most suitable at one part of the cop are not those which would be chosen if only another part had to be considered. The use of a continuously varying speed is designed to overcome this difficulty and to produce a perfectly constant tension on the yarn, the speed being increased where the tension due to the traveler would otherwise be too light and decreased where it would be too heavy.

The system of speed variation which I am about to describe is due to Brown, Boveri and Co. who found that it was a distinct advantage if the speed of the frame could be altered whilst running, so that not only could different counts be spun at different speeds, but that different speeds might be employed for spinning the base, the middle, and the top of the bobbin. They produced for this purpose an electric motor which can run equally well at any speed between wide limits.

It was known theoretically that the tensions on the thread could be maintained constant by varying the speed with the rise and fall of the ring rail. In order to devise a proper system of speed variation it was first necessary to establish clearly the relations between the simultaneous values of the tensions at the several points in the yarn between the rollers and the bobbin and the variation of each of these tensions throughout the spinning of the set. At any given moment while the spindle is running the tensions in the thread between the rollers and the eye, at the top and bottom of the balloon and between the traveler and the bobbin will all be different, and reach will vary continuously throughout the set. Of these, only the tension between the rollers and the eye can be measured directly while the frame is spinning in the normal way, and this can only be done by observing, on a spring balance or otherwise, the pull required to deflect the thread out of its natural position, and then calculating the tension in the thread by a triangle of forces. The practical objections are, that owing to the speed at which the tension varies, it is virtually impossible to obtain accurately simultaneous observations of the tension on the spring balance and the angles which the latter makes with the thread. Also, as the yarn can not be drawn far out of its position, the tension on the spring balance can only be a small fraction of the pull in the thread (which is itself only small), so that any inaccuracy in observation is multiplied on the drawing board.

It was therefore necessary to approach this problem in another way by calculating all these tensions from the visible shape of the balloons, which can be obtained by photographing them. Fig. 2 is a photograph taken of a thread ballooning on a frame driven at constant speed and spinning 20's twist, the speed of the spindle being 8,160 revs. per minute, the traveler a No. 3, the diameter of the ring 1⅜ inches

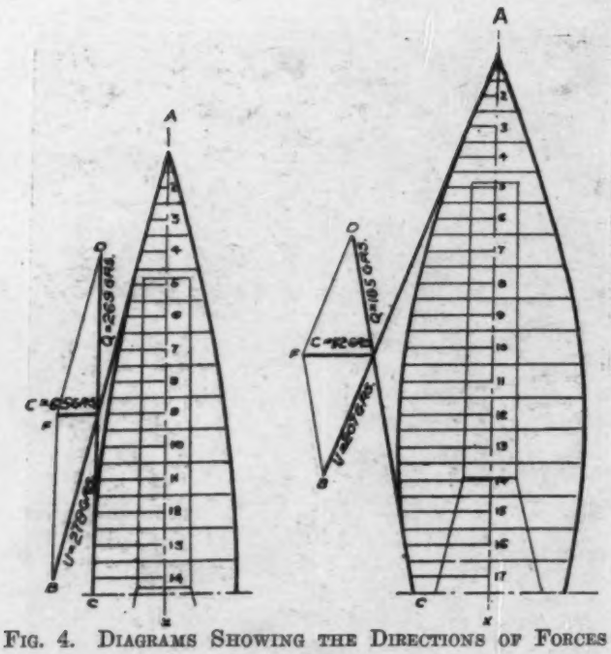


FIG. 4. DIAGRAMS SHOWING THE DIRECTIONS OF FORCES ACTING ON THE YARN FORMING THE BALLOONS.

of the full bobbin 1¼ inches and of the empty bobbin ⅜ inch. This photograph was taken while spinning on the largest diameter of the bobbin. The shape of this balloon is due to the action of three forces namely, the tensions in the thread at the top and bottom (which are tending to reduce the size of the balloon), and centrifugal force (which is tending to increase it). These three forces must always be in equilibrium. Fig. 3 shows the balloon at the same spindle when the rail has risen which as will be noticed is smaller than in Fig. 2. Similarly in this position also these three forces must be in equilibrium. These two photographs were taken during a consecutive rise and fall of the rail, and show the balloons when spinning on to the largest and smallest diameters respectively. The photographs of these balloons were then traced and reproduced graphically, as shown in Fig. 4. Knowing that the tensions at the top and bottom of the balloons as represented by the lines A B and C D respectively must act tangentially to the curve of the balloon at those points, it was easy to draw the tangents A B and C D and so construct the triangle of forces E B F, the centrifugal force represented by E F acting at right angles to the axis A X of the spindle. Having the actual value of the centrifugal force, the apparent tensions in the thread could be easily obtained by proportion. Their values are given in Fig. 4.

These are, however, only the apparent tensions and not the actual tensions in the thread at these points, because the photograph gives not the real shape of the balloon but its shape in one plane, as it appears to the eye. In reality the shape of the balloon is not quite as seen, because windage deflects it in a plane at right angles to that of its motion, and therefore to that of the photograph. By experimenting with large balloons the fact was established that in any balloon the backward deflection due to windage is similar and equal to the outward deflection due to centrifugal force. As it is possible to calculate windage in a similar way to centrifugal force, the angle and magnitude of the tensions produced by it at the top and bottom of the balloons could be obtained. The sum of the tensions due to centrifugal force and windage is the true tension in the thread. The windage was found to increase the tensions due to centrifugal force by about ten per cent. In this way the actual tensions at the top and bottom of the balloon respectively can be found for any position of the ring rail.

The tensions in the thread between the traveler and the bobbin can not be measured directly, so they were obtained indirectly from the tension at the bottom of the balloon. This was done by reconstructing the conditions with a traveler. The angle at which the thread enters the traveler is found from the photograph, the angle at which it leaves is known from the dimensions of the ring and cop, since the thread must form a tangent to the latter. The forces required to drag the yarn through the traveler at these angles, at a speed equal to the known delivery of the rollers and against the known pull C D (at the base of the balloon) were then found by actual experiment.

In this way the tensions in the yarn at the three different points—at the top of the balloon; at the bottom of

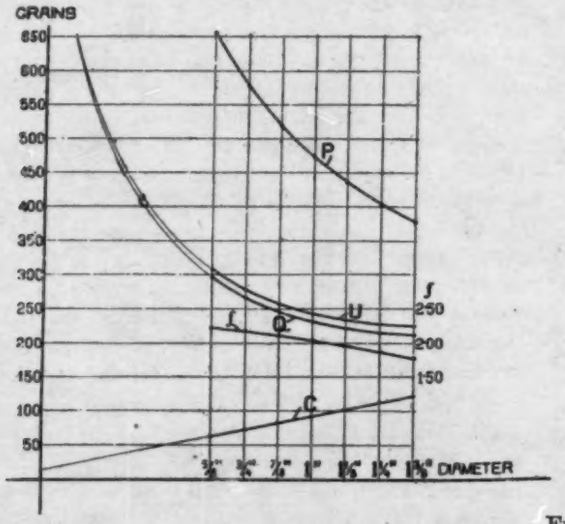


FIG. 5. CHART SHOWING VARIATIONS OF TENSION DURING THE TRAVERSE OF THE RAIL. CONSTANT SPEED.

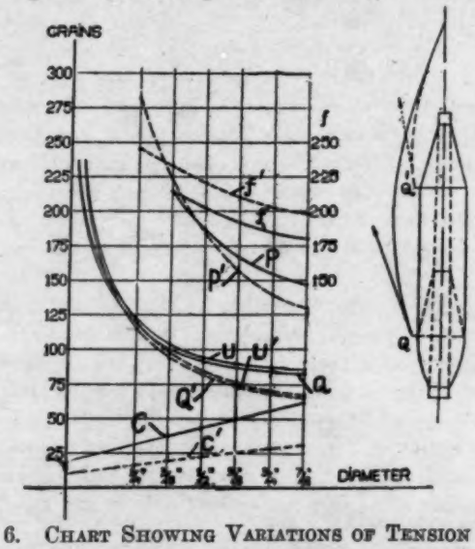


FIG. 6. CHART SHOWING VARIATIONS OF TENSION DURING THE TRAVERSE ON EMPTY AND FULL BOBBINS. CONSTANT SPEED.

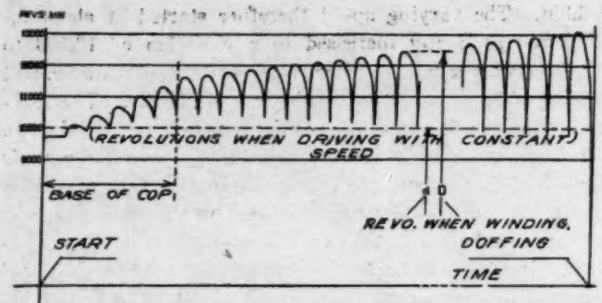


FIG. 8. CHART SHOWING SPEED VARIATIONS TO KEEP THE BALLOONING THE SAME, IRRESPECTIVE OF ITS SIZE.

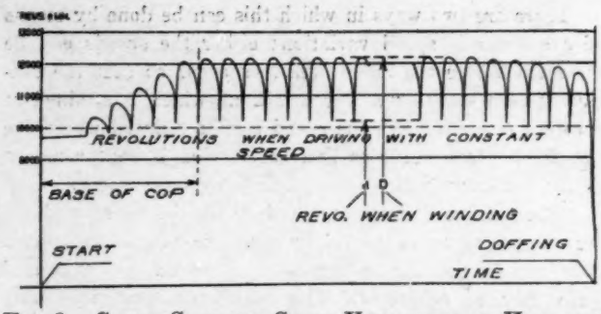


FIG. 9. CHART SHOWING SPEED VARIATIONS TO KEEP THE BALLOONING THE SAME, AND THE SAME SIZE.

the balloon; and between the traveler and the cop—were all derived from the two photographs which were taken with the ring rail in the two extreme positions of one consecutive rise and fall. Other photographs were taken with the ring rail in various positions intermediate between these limits and the values of these three tensions calculated from each. The results derived from this series of photographs are best shown as curves in Fig. 5, which clearly shows how each tension various throughout each fall and rise of the rail. The curve U shows the variation at the top of the balloon (this tension is proportional to that at the rollers) while the curve Q shows the variation in tension at the bottom of the balloon. It can be seen that these two tensions vary practically proportionally, though owing to the shape of the balloon the tension is always slightly greater at the top. The curve f is the proportion which was found to exist in this particular case between the tensions on each side of the traveler. The curve P shows the variation in tension between the traveler and the cop, and was found by multiplying the tensions at the base of the balloon (Q) by the corresponding value of f. The curve C is simply the centrifugal forces of the balloons which have been plotted as a check on the accuracy of the calculations; it should pass through zero since a balloon of no diameter has no centrifugal force. The inaccuracy is shown to be very small.

This Fig. 5, however, only shows the variation in the tensions during one particular rise and fall of the ring rail, but it was, of course, obvious that the *length* of the balloons had a very pronounced effect on the various tensions. More photographs, therefore, had to be taken while other parts of the cop were being spun, and further calculations had to be made. The corresponding values of these tensions during one rise and fall of the ring rail at extreme ends of a cop are given in Fig. 6. These curves were not obtained from the same frame as those shown in Fig. 5. In this case the spindle was spinning 40's counts at a speed of 10,000 revs. per minute, the diameter of the ring was 1⅛ inches and the traveler a 0/7. The curves in heavy line represent the tensions while spinning a layer just after the base was formed, and the dotted lines represent the tensions while spinning a layer at the extreme top of the cop, the two positions being represented in the diagram at the right.

It will be noticed from these curves that the greatest variation in tension occurs between the traveler and the bobbin; in this latter case it varies from 130 to 280 grains, that is to say, by about 115 per cent. The tension U at the top of the balloon, or between the wire eye and the rollers, varies from 70 to 120 grains, or by about 70 per cent. The latter tension is undoubtedly the more important, because it is the tension on the yarn at the moment it leaves the rollers and while it is still untwisted, whereas the former is applied only to the fully spun yarn and affects only the tightness of the bobbin. It is therefore plain that speed variation should be devoted to maintaining an even tension at the rollers; in other words, to making the curve U a straight line, so that the ***draft on the yarn is kept uniform throughout the cop and every inch spun is subjected to exactly the same treatment.***

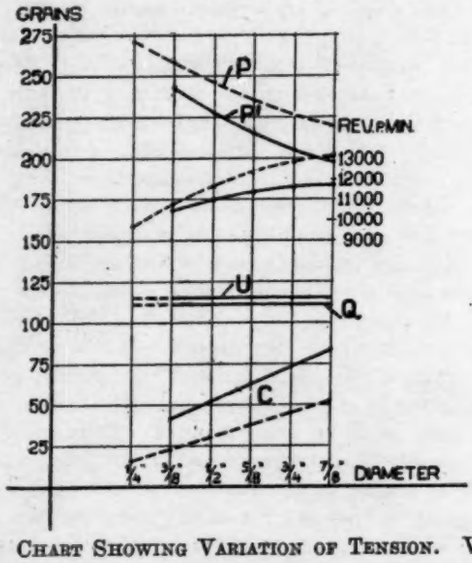


FIG. 7. CHART SHOWING VARIATION OF TENSION. VARIABLE SPEED.

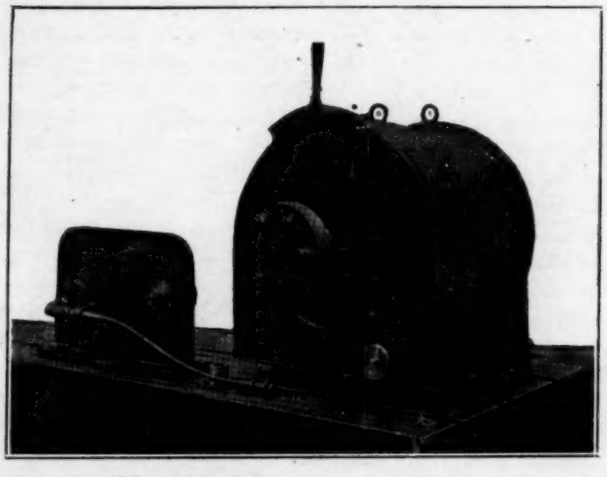


FIG. 10. MOTOR AND EQUIPMENT FOR PRODUUCING THE VARIABLE SPEED.

There are two ways in which this can be done by means of a systematic speed variation; either the speeds can be increased where the lighter tensions occur so that the tension is kept constant at the maximum which is attained at constant speed, or else the speed can be reduced where the heavier tensions occur so that the tension is kept constant at the minimum which is reached at constant speed.

When using a constant speed drive, the speed and the travelers have to be so chosen that the maximum tension does not exceed the safe tension to which the untwisted yarn may be subjected. This maximum tension is only reached at a comparatively few points in the bobbin, and during the remainder of the time the tension is well within the safe limits. Clearly, therefore, it is the right thing to increase the speeds and the tension where they are unnecessarily low. As, however, when a frame is driven at constant speed the tensions in the interests of output are brought up as nearly as possible to the breaking strain, the breakages can be very appreciably reduced by slightly reducing the speeds at the points at which the maximum tensions occur, as well as by increasing them everywhere else, the speeds being so adjusted as to maintain a tension rather below the maximum attained at constant speed.

When a continuously varying speed is used, the yarn is never subjected to so great a tension as at constant speed, and at the same time the output of the frame is very much *increased*. In this way the varying speed both decreases the breakages and increases the output. On the other hand, if a ring frame is working at constant speed with the most suitable traveler—that is, the lightest which will satisfactorily retain the balloons just after the bases are formed, when the tendency to balloon is greatest—then the only way to decrease the maximum tensions and reduce the breakages, while still using constant speed, is to reduce that speed, which will, of course, at the same time reduce the output. This, briefly, is the reason for employing a continuously varying speed.

Alteration of the speed to maintain the tension U constant will, of course, also affect the tensions at the other points. The result is well shown in the case of the frame from which the curves in Fig. 6 were obtained. This was afterwards run at a continuously varying speed, the counts (40's) remaining the same, but the travelers being changed to one size lighter, namely, 0/8's, as the varying speed made this possible. A new set of curves were obtained under the new conditions, and these are shown in Fig. 7.

The tension U was intentionally made uniform and slightly below its previous maximum of 120 grains so that its curve became a straight line at about 112 grains. The tensions Q also became a straight line, as before, at a value rather below that of the tension U. The tensions P^1 both at the top (dotted curve) and P at the bottom (full line curve) of the balloon became more nearly constant, the variation being now from 200 to 275 grains as against 130 to 280 grains with the constant speed. This means that the bobbin was more tightly wound at the varying speed.

The speed variation which was necessary theoretically to keep the tension U constant is shown in Fig. 8. This is a diagrammatic curve of the speed variation throughout a complete bobbin, each up and down portion representing an increase and decrease in the speed corresponding to a fall and rise of the ring rail. The maximum tensions at constant speed of 10,000 revs. per minute occurred when spinning on to the bare bobbin at the extreme ends of the bobbin. The varying speed therefore started at about 9,700, and gradually increased to a variation of 10,500 to 11,600 revs. per minute after the formation of the base, and finally of 9,700 to 13,100 at the end of the set. The theoretical reason for this increase in speed when spinning on the large diameter of the cop towards the end of the set is seen in Fig. 6 where the curves U and U^1 show a smaller value for the tension when spinning on the large diameter at the top of the cop than on the same diameter at the bottom. It was soon found in practice that this rise in speed as the balloons became short is not advisable, its effect being practically to wipe out the balloon altogether.

As long as the thread forms a balloon, any slight lump in the yarn only causes the balloon to "twitch" as it passes through the traveler, but when there is no balloon at all and the thread passes in a straight line from guide to traveler, the passing of very small lumps through the latter jerks the thread and produces excessive tensions which cause breakages. It is therefore necessary to reduce all the speeds slightly towards the top of the bobbin, in order to gain from the elasticity of the balloons so produced.

The actual speed variation as applied to the frame in question is shown in Fig. 9, which is a typical speed curve for a frame working at continuously varying speed on the Brown-Boveri system.

The frame at starting runs at a speed which is somewhat below that at which it would run with constant speed drive. The first few layers, which are of uniform diameter, are laid on at this speed, which must remain constant while the rail moves up and down. As the bases of the bobbin form, the speed must be slightly increased with each fall of the ring rail, and reduced again as it rises, the maximum becoming greater at each consecutive fall. The maximum variation is attained just after the bases are formed, and it will be noticed that the minimum speed is now above the normal constant speed, this being made possible because at constant speed the maximum tensions occur only at the beginning and end of the set. This speed variation is maintained until the effect of the gradually shortening balloons becomes appreciable, when the limits between which the speed is varied are slowly and gradually reduced until the completion of the set.

To sum up, it may be said that there must be a different speed when spinning on to each diameter between that of the bare bobbin and that of the full cop, but that the speed for each must vary with the length of the balloon. In order to carry this system into effect it is necessary first to be able to drive the frame at any speed between the limits which may be required. An ordinary electric motor will not do, as it is not sufficient to have three, four, or any other number of different speeds. As a frame spins, the tensions must vary gradually—not in steps—hence the speed must be varied gradually and evenly up and down, and must not be changed simply from one set speed to another.

The patented type of variable speed motor which was found to fulfil all the requirements for this varying speed drive is shown in Fig. 10. Such motors are controlled solely by the handle seen at the top of the motor, no other switch-gear whatever being required. Their speed can be varied at will by simple movement of this lever, which may be left as desired in any position between "standing" and "full speed." They can run at any speed between the limits for which they are built (the range most suitable for the majority of frames is from 700 to 1,100 revs. per

minute), and it is, for instance, quite possible to set the speed for 720 revs. per minute and then to alter it instantaneously either up to 730 or down to 710 revs. per minute, or even increase it in a few seconds from 700 right up to 1,100 revs. per minute.

As each frame in a room spins independently of the others, it is necessary to drive each by a separate motor, and as the speed must be varied continuously and in step with the spinning, the speed of each motor must be controlled automatically from the mechanism of the frame it is driving.

The motor shown in Fig. 10 is directly coupled to the shaft of one of the tin rollers through a simple flexible coupling, one-half of which is shown in this illustration attached to the motor shaft. The controlling handle of the motor is connected by a flexible steel wire to the automatic gear, the back of which is seen in this view.

Two separate and distinct motions are transmitted from the headstock of the frame to a special automatic gear, which combines the two and applies the resultant movement in a suitable form to the regulating handle of the motor.

The two motions which are utilized are, firstly, that of the heart shaft for varying the speed with the reciprocating movement of the ring rail, and secondly, that of the builder wheel for varying the limits as the bobbin forms.—Journal of the Manchester Municipal School of Technology Textile Society.

The import of woolen cloth and serge into Japan has experienced this year a notable impetus. In July alone the imports amounted in value to 633,000 yen, as against 246,000 yen in July of last year. The total imports of the first seven months of this year (January to July inclusive) amounted to 2,173,000 yen, as against 843,000 yen during the same period of last year. The general opinion is that these enormous advances are the result of the increased customs tariff, which will come into operation in 1911.

DETAILS OF A FINE SPINNING MULE.

FACTORS NECESSARY IN A FINE SPINNING MULE—ARRANGEMENT OF THE DRIVE—THE ROLLER MOTION AND ROLLER DELIVERY MOTION.

(Contributed exclusively to COTTON*)*

BY WM. SCOTT TAGGART, M. I. MECH. E.

The particular mule about to be described is the type made by Richard Threlfall of Bolton, England. It is one that is extensively used for the production of very fine yarns, but in spite of this one may look in vain for drawing and description of it in any of the usual textile books. It will, therefore, probably, be interesting to students and workers in the cotton mills to have a general idea of a machine upon which some of the finest yarns in the world are spun.

The term "fine spinning" is somewhat elastic, and many people use it in a comparative sense. For the purpose of these articles we may say that the mule about to be described is used for spinning from 120's upwards. It is very important to note that spinning fine numbers involves the use of long fibers of a frail character, and consequently a slower and more delicate treatment is necessary. Speaking generally, it will be found that the following factors contribute to the building up of a fine spinning mule:

(1) Shorter and thinner spindles with a finer point; (2) slow movement of the carriage on its outward journey during the spinning operation; (3) increased speed of the spindles during the spinning, owing to the increased twists required. This extra twist is not all put in as the carriage comes out, but after the carriage has stopped on the outward run and before backing off takes place. To do this a double speed driving is necessary; (4) the inward movement of the carriage to be quick; (5) a variable stretch so that there is not too long a length of yarn exposed. This necessitates a short shaper that lends itself to variations; (6) drawing-up and backing-off motions actuated by inde-

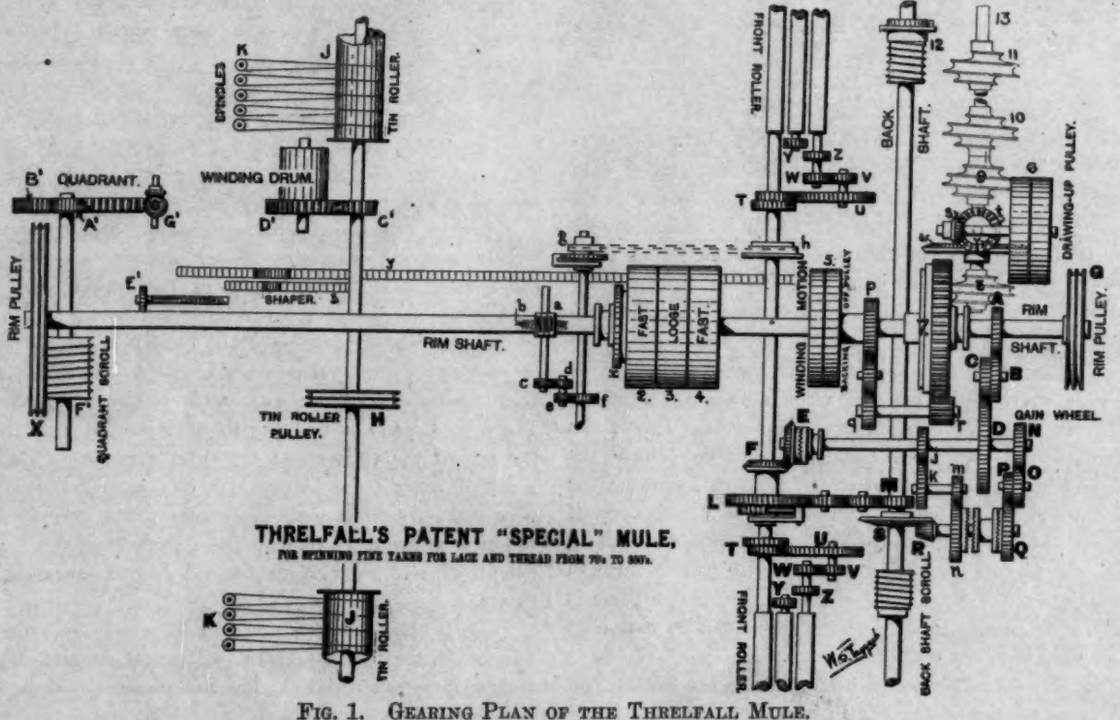
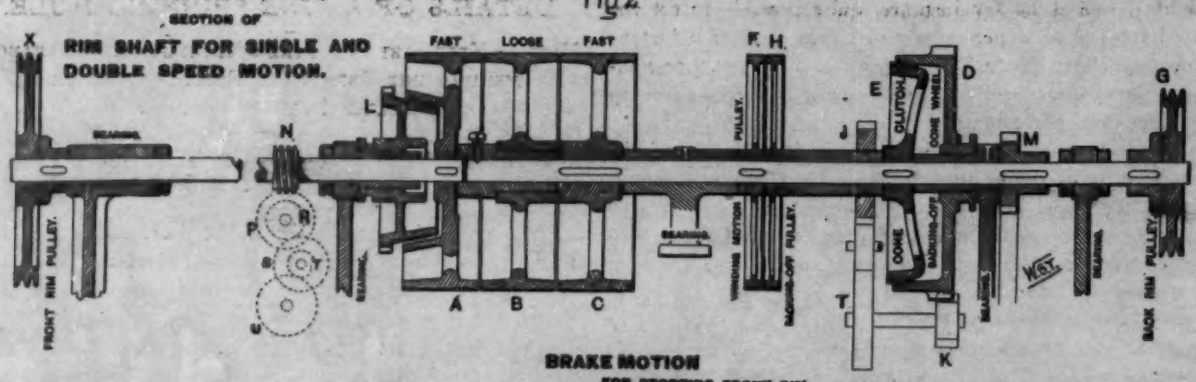


FIG. 1. GEARING PLAN OF THE THRELFALL MULE.

Fig.2



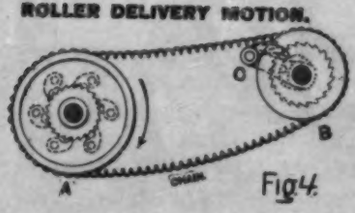


Fig.4.

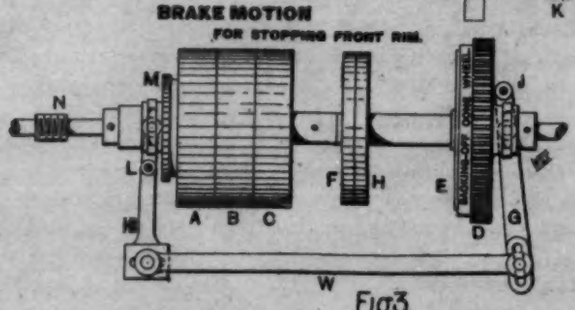


Fig.3.

Fig.5.

Different Motions Found on the Threlfall Mule.

pendent driving, either by belts or bands; (7) a winding motion to assist the quadrant and prevent snarls just as winding is being completed; (8) roller motion; (9) jacking or ratch motions; and (10) a short and thinner cop. This is necessary because it is a slow process to build a large cop of fine yarn and the longer time a cop is exposed it becomes dirty with fluff, etc., and develops a fuzziness, to its detriment as a salable article.

A gearing plan of the mule as shown in Fig. 1 will convey some idea of the arrangement of the drive adopted. A long rim shaft (seen in cross section in Fig. 2) stretches the full length of the headstock and is made in two parts. When the belt strap is on the fast pulley 4 in Fig. 1 the back half of the rim shaft is being driven, and through the back rim pulley G the spindles receive their motion during the outward run of the carriage. Spinning or twisting is performed at this stage.

When the carriage has finished the run out and is stationary, the belt strap is moved from the fast pulley 4 to the fast pulley 2 which at once causes the larger front rim pulley X to drive the spindles at an increased speed. This is termed twisting at the head, and it continues until the required twists are put in the yarn.

It will readily be understood that the high twists required for fine counts would place a very severe strain on the few delicate fibers composing the yarn, especially in the earlier part of the run out when only a short length of yarn can receive the strain, but when a long length has run out there is sufficient elasticity in it to relieve the strain, and sufficient vibration of the yarn to distribute the twists throughout its length. Of course it is a matter of judgment based on experience as to what twists to put in through the rim pulley G and how much to put in through the rim pulley X. Both pulleys are changeable so there is a fairly wide change to such—both alterations in cotton as well as variations in counts of yarn.

After the extra twist has been put in, the backing-off action takes place and the run-in is made.

Referring again to Fig. 1, two pulleys are shown at 5 one of which (see F, Fig. 2) is the assistant winding pulley, whilst the other (see H, Fig. 2) drives the backing-off. One belt is used for both pulleys. The drawing-up is performed by a separate driving arrangement. Fast and loose pulleys are shown at 6, Fig. 1, and through the gearing s, t, w, y, the scroll shaft 13 is driven without the usual means of a cone clutch as found in mules spinning lower numbers.

The front roller is driven through the gears A, B, C, D, E and F. The "roller motion" is effected from the back shaft through the gear wheels M to L. The back shaft is driven from the rim shaft by means of gears A, B, C, D, j, k, m, n, R and S, whilst the gain motion is transmitted from the rim shaft through the gears A, B, C, D, N, O, P, Q, R and S. In regard to the roller delivery motion whilst twisting at the head, the front roller is driven from the rim shaft through a worm "a" driving a worm wheel "b", and then on through the wheels c, d, e, f, and the pulleys g and h.

There is sometimes a misunderstanding in regard to the "roller motion" and the "roller delivery motion." The roller motion is the revolving of the rollers very slowly during the run-in of the carriage; whilst the roller delivery motion whilst twisting at the head is a method adopted to pay out a little yarn to make up for the tightening effect produced through the yarn being rapidly twisted. There is already a full length of stretched yarn between the nip of the rollers and the spindle point, so that when a lot of extra twist is put into this yarn it would otherwise certainly snap with the severe strain put on it. The strain is relieved by causing the rollers to deliver just sufficient yarn to compensate for the length absorbed by the twists.

Fig. 2 clearly shows the disposition of the pulleys and wheels on the rim shaft and will assist in making Fig. 1 clearer in several points. The independent backing-off belt is practically always on the pulley H, but is non-effective

except during backing-off because it drives the backing-off wheel D through the gear wheels J, r, K and D; and D it will be noted runs loose on the boss of the bracket supporting the rim shaft. When the wheel D is put into contact with the cone clutch E which is keyed to the rim shaft, we then have the belt on the pulley H driving the rim shaft, and through the pulley G driving the spindles the reverse way during backing-off.

It is only just as the winding operation is being completed and the carriage nears the roller beam that the strap is moved slightly for a moment from the pulley H to the pulley F, and since F is keyed, as shown, to the rim shaft we obtain a slight extra speed given to the spindles, which extra speed has the effect of assisting the quadrant in winding on quickly any slackness in the yarn that may exist and so prevent snarls forming.

Fig. 3 shows a brake motion for stopping the pulley A at the moment the backing-off wheel is put in clutch. The gearing of the roller delivery motion is driven through the worm N in Fig. 2 whilst the free wheel arrangements on the chain pulleys of the same motion are given in Fig. 4. The detailed arrangement of the click wheel for the roller motion is shown in Fig. 5.

(To be Continued.)

THE MANUFACTURE OF ARTIFICIAL SILK FROM COTTON.

INCEPTION AND DEVELOPMENT OF THIS INDUSTRY—DIFFERENT METHODS DESCRIBED OF MAKING ARTIFICIAL SILK—PRESENT STATUS.

(Contributed exclusively to COTTON*)*

BY H. R. CARTER.

PART I.

The technical idea involved in the spinning of artificial silk is an old one. Its first inception appears to be due to Reaumur, who, as early as 1734 forecasted its possibility. It is thought that early inventors, finding that the silk worn ate the leaves of the mulberry tree, considered that the chief constituent of the latter must enter largely into the composition of silk. At any rate in 1855 Audemars of Lausanne took out a patent for a process consisting in reducing the young branches of the mulberry tree to a paste, which, with other constituents, he formed into a sticky solution capable of being drawn into a thread, then dried and wound upon a bobbin.

The semi-liquid consistency of natural silk as it leaves the silk worm and solidifies rapidly in the air, has been the starting point of the various inventors who have brought the manufacture of artificial silk to its present state of development. Their first problem was the production of a viscous liquid analogous to that naturally existing in the glands of the silk worm, and the second the conversion of this liquid into fine threads. Audemars succeeded in the production of a viscous liquid from the wood of the mulberry tree for the then unknown reason that wood consists of cellulose in a more or less pure state, and that this substance, cellulose $C_6 H_{10} O_5$ in one form or another, is the material used as a base by the producers of artificial silk under almost every process.

The artificial silks of today may be divided into four divisions:

1. Chardonnet, Lehner and DuVivier silks of pyroxylin or collodion, produced from solutions of nitrate of cellulose or gun cotton in alcohol and ether.

2. Pauly, Linkmayer, Theile and Bronnert silks, produced from solutions of cellulose in ammoniacal solution of copper oxide or in chloride of zinc.

3. Viscose silk made from a solution of thiocarbonate of cellulose.

4. Gelatine silks treated with formaldehyde, the last named or Vanduara silk being now little if at all used.

To Chardonnet belongs the honor of having been the first to establish an industrial process and to obtain a commercial silk. The date of his first French patent is November 17, 1884, and that of his English patent, 1885. Briefly described his original process was as follows: Purified cellulose obtained from cotton, wood, etc., was nitrated, producing gun cotton, soluble in a mixture of alcohol and ether. Aniline colors were added to color the silk. The viscous solution obtained he called "mother of silk." He introduced it into a closed vessel which he put under air pressure of several atmospheres by means of an air pump. In the lower part of this vessel there were several "filieres" formed of glass capillary tubes with a diameter of 1/6 m m and terminating in a trough of water. The solution of cellulose nitrate was thus forced out in fine threads which solidified at once and were dried in the air.

Many difficulties were met with at first. The highly explosive and inflammable character of the material produced by this cellulose nitrate process was one of the greatest objections. The first remedy for this defect was found in treating the silk with a cuprie ammonia solution, and then with phosphorate of ammonia.

In 1890 Lehner discovered that the addition of sulphuric acid to Chardonnet's collodion of cellulose nitrate solution considerably lowered its viscosity and permitted the use of a 15 per cent. solution under lower pressure than that required by Chardonnet. Chardonnet's first works were at Spreitenbach near Zurich. In 1893 a company was promoted and works started at Besancon. The first English company to manufacture silk by the Chardonnet process operated in 1896 at Bradford. It had a share capital of $1,000,000 out of which sum $700,000 was paid, in shares and cost, for patents. In 1899 a factory was started at Wolston, near Coventry, England. These first companies experienced great difficulties owing to government regulations concerning the use of pure alcohol.

Chardonnet and Lehner silks are now treated with reducing agents to remove the nitric acid or to denitrate the product, thus rendering it less inflammable. A further treatment with aluminum acetate renders them still less combustible as well as more resistant to the softening action of water.

In 1892 Cross, Bevan and Beadle patented their discovery that cellulose could be dissolved by treating it successively with strong alkalies and carbon bisulphide, and in 1894 Stearn produced artificial silk from this solution by forcing it through capillary openings into a precipitating liquid such as chloride of ammonia. Lustra cellulose or Viscose silk is thus produced. In 1897 Pauly discovered the application to the manufacture of artificial silk, of John Mercer's discovery that cellulose would dissolve in a strong solution of copper oxide in ammonia (cuprammonia.) He found that when treated with an acid, the cellulose is set free in a perfectly white condition, the

acid binding the copper. Pauly's silk was put on the market under the name of Glanzstoff by the Verlinigte Glanzstoff Fabriken A. G. of Aachen and Elberfeld.

In 1899 artificial silk was still regarded as an industrial curiosity with a probable future. In 1900 it began to attain an unassailable position as a textile. The next five years were marked by phenomenal development and the daily output became enormous, being estimated at 7,000 tons per annum or about one-seventh of the consumption of natural silk. Of the quantity named the bulk is manufactured on the Continent. Taking the yearly production of artificial silk at the figure above named, about 2,000 tons are made from nitro-cellulose, 1,000 tons from hydrate of cellulose dissolved in cupric ammonia, the remainder being Viscose silk which is manufactured on a large scale at Coventry. Taking the average price at two dollars a pound, the consumption of artificial silk reaches a value of nearly $30,000,000 per annum.

Already at least 30,000 hands are employed in the artificial silk industry. Leading Continental firms have already written down their works, plant and rights to a nominal amount out of the abnormal profits of the past. The leading Continental companies have been realizing enormous profits. For instance, in April, 1908, the Belgian Company, at Tubise, reported a profit of $390,000 on a capital of only $260,000 and had orders on hand for 600 tons of silk. In the same year a leading German company paid 40 per cent. dividend against 35 per cent. the previous year. As is generally the case when business booms, the production of artificial silk has been increased to an abnormal extent so much so that the industry is at the time of writing in a temporarily unsatisfactory condition. The principal French firms have consequently come to an agreement to regulate production and to find new channels for the utilization of their product.

Silk produced by the nitro-cellulose process is being slowly replaced on the market by the products prepared by the other processes, most notably Viscose which on account of the comparative cheapness of the raw materials and process has a promising future. The expense of the cuprammonia process has brought more than one company to grief. Artificial silk has hitherto been principally used for trimmings, etc., but there is no doubt that satisfactory all-silk fabrics can be and will presently be produced in quantity.

Some of the advantages of artificial silk are: (1) Its cheapness as compared with natural silk of good quality; (2) its luster, which is considerably greater than that of natural silk; and (3) its stiffness which renders it very suitable for fringes, braids and tassels.

The acknowledged disadvantages of artificial silk are: Its lack of tensile strength while wet; its moderate degree of elasticity as compared with natural silk; and its higher specific gravity than natural silk producing less covering power. Although innumerable patents have been taken out in every branch of this important industry, there is still plenty of scope for improvements in the spinning mechanism and methods of manufacture. It is very desirable that the strength of the silk when in a moist condition should be improved and that broken filaments should be avoided.

(To be Continued.)

LENO CLOTH WEAVING.

JUMPER AND YOKE IN USE ON HEMSTITCHED LENO.

(Contributed exclusively to COTTON*)*

BY PROF. THOMAS NELSON.

PART III.

It will be recalled that when making a hemstitch leno with a bottom doup, the standard harness is never raised, the leno being made by the crossing end passing under the standard end from one side to the other. When a single action dobby is used, that is, one which has only one lifting knife and the harnesses return to the bottom shed every pick; additional attachments to the dobby, such as the jumper and yoke are not used, because the change from

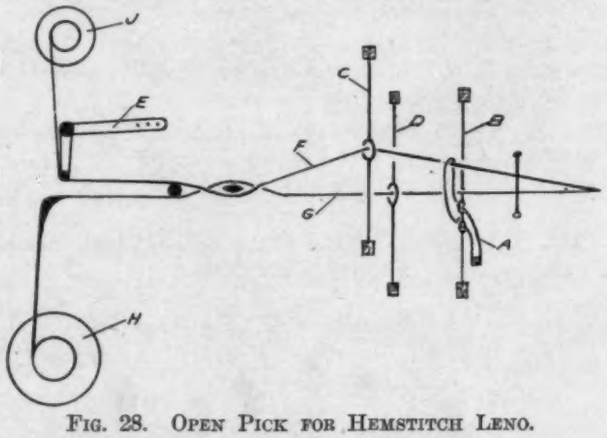


FIG. 28. OPEN PICK FOR HEMSTITCH LENO.

crossed to open picks, or open to crossed picks is made from the bottom shed, and this gives a straight lift to the harness. When, however, a double action dobby is used, that is, one which has two knives; one knife returning when the other is on its outward movement, the jumper and yoke attachment must be used if the hemstitch leno is to be made on this style of dobby. Very few single action dobbies are in use at the present time except in the older mills and these in many cases are being replaced with the more up-to-date double action dobby.

In order to more clearly demonstrate why these two additional attachments have to be used, the movements of the crossing thread are illustrated at Figs. 28, 29 and 30. Fig. 28 illustrates the doup A and the crossing harness C raised. The doup harness B and standard harness D are

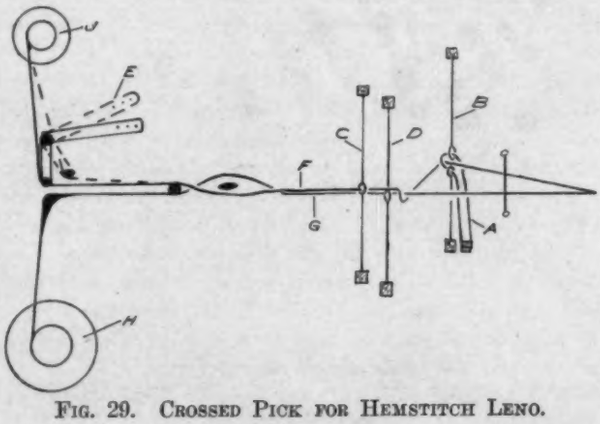


FIG. 29. CROSSED PICK FOR HEMSTITCH LENO.

not raised. The crossing end F is on the left hand side of the standard end G. The change to the crossed pick is illustrated at Fig. 29. The doup A and doup harness B are raised. The crossing harness C and standard harness D are not raised. The crossing end F is now on the right hand side of standard end G. It will, therefore, be seen that—if the crossing end F is on the left hand side of standard end G on the first pick and on the right hand side of standard end on second pick, and the standard end G not being raised—some attachment will have to be used to raise the standard harness D high enough on each pick to allow the crossing end F to pass under freely.

To further illustrate: It must be remembered that on a double action dobby, as one knife is on its outward movement the other is on its inward movement, and when the knives pass each other, the harnesses which are operating will be in the middle of the shed. Now, suppose that the open pick has been made and the harnesses are changing for the crossed pick. One of the knives which is on its inward movement is lowering the crossing harness C. The other knife which is on its outward movement is raising doup A and doup harness B. When the two knives are passing each other, crossing harness C will have been lowered half the distance, and the doup A and doup harness B will have been raised half the distance. The crossing end F will, therefore, be raised on both sides of the standard end G at the same time which will put such a strain on both the standard end and the doup that, even if they could be woven under this strain, would be continually breaking. This is clearly illustrated at Fig. 30. If the heddle eyes of the standard harness D had been raised to a position indicated by the dotted line x x'; the crossing end F could then have passed under the standard end G easily and without any strain on either the doup or standard end.

THE JUMPER.

The jumper is used for the purpose of slightly raising the standard harness so as to allow the easy passing of the crossing end under the standard end. It is only necessary to raise the standard harness about half way in the shed, or in other words, just sufficient to allow the crossing end to pass under when changing from open pick to crossed pick, and vice versa.

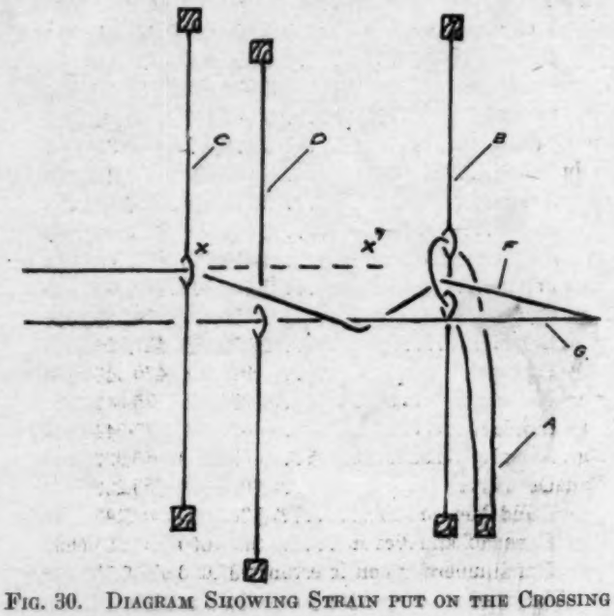


FIG. 30. DIAGRAM SHOWING STRAIN PUT ON THE CROSSING THREAD.

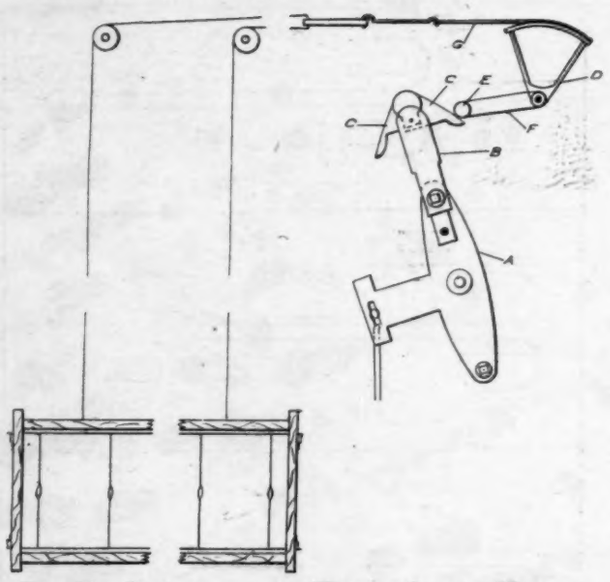


FIG. 31. DIAGRAM OF THE WHITIN JUMPER MOTION.

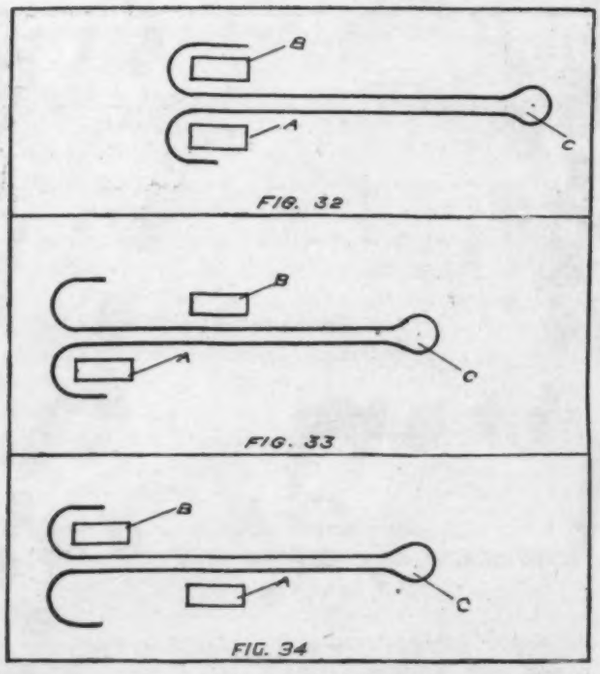
There are several makes of jumpers, but all are for the same purpose. The jumper illustrated at Fig. 31 is considered one of the best, and is in use on the Whitin dobby. The construction and operation of the jumper are as follows: An extension arm B is bolted to the regular rocking arm A of the dobby. On the extension arm B two adjustable wings C are placed. These wings being adjustable can be set in the most suitable position. A quadrant D is secured to a shaft which extends from the front of the dobby to the back, and is located above the jack hooks in the dobby. A strap G is fixed to the quadrant which is in turn connected through cords to the standard harness. A small roller E which is held by a stud connected to the lever F is raised and lowered by the wings C as the rocker arm A oscillates.

Since the lever F is secured on the same shaft as the quadrant D, the harness is raised the required distance and then lowered. Fig. 31 illustrates position of the jumper with the standard harness at the bottom of the shed. When the ball E is on the highest point of C, it raises the standard harness the required distance to allow the crossing end to pass under the ground thread. This happens when the rocking arm is vertical. The standard harness should be so set as to be raised about half way in the shed. It will readily be seen that if the standard harness is set correctly, it will be raised to the highest position when the other harnesses which are changing are in the center of the shed. The adjustable wings can be set so as to give a quicker or slower movement to the standard harness as desired.

As the rocking arm A oscillates to the right past the vertical, the roller E will be lowered on the opposite side of the adjustable wings and the harness lowered. The standard harness is, therefore, raised half way in the shed on every pick in time for the crossing end to pass under freely. This raising of the standard harness is accomplished while the shuttle is in the shuttle box.

THE YOKE.

In connection with the operation of the jumper, a yoke is used. This mechanism is simply a piece of wire as



FIGS. 32, 33 and 34. DIAGRAMS SHOWING THE DIFFERENT POSITIONS OF THE YOKE ATTACHMENT DURING WEAVING.

shown in Fig. 32. In ordinary weaving the harness shafts are connected, through harness straps, to harness levers in the dobby. When a hemstitch leno is made, the doup is not connected to the harness lever in the dobby but to the loop C in the yoke. The doup harness is connected to a harness lever in the dobby. In the diagram, A represents the first harness lever in the dobby, and B the second harness lever. The bends or hooks of the yoke are behind the harness levers, as shown.

In order to understand the operation of this mechanism it will be necessary to specially notice the movements of the harness without the yoke, that is, the doup connected to the harness lever in the dobby. Suppose the open pick has been made and the top knife of the dobby is in its outward position, and the change is being made to produce the crossed pick. The crossing harness and doup are in a raised position before the change is made. Now in order to make the crossed pick, the doup A which is on one side of the standard end G, (See Fig. 28) must be raised to the opposite side of the standard end, and this is accomplished by raising the doup harness B (See Fig. 29). For the open pick the top knife in dobby is in its outward position, with the bottom knife in. When the top knife is coming in, the bottom knife is going out; and with these movements the doup is being lowered by the top knife and the doup and doup harness are being raised by the bottom knife. The result is that as the doup and doup harness meet in the center of shed there is a small amount of loose doup which kinks in the shed and almost invariably breaks out yarn.

Now, if the doup is connected to the yoke a slightly different movement is given to the doup when changing. As the kinks in the doup are caused by the doup being raised by the harness lever on both open and crossed picks, the peg which caused the doup to be raised on crossed picks is left out. Note the result: The open pick is made exactly the same; the crossing harness and doup are raised

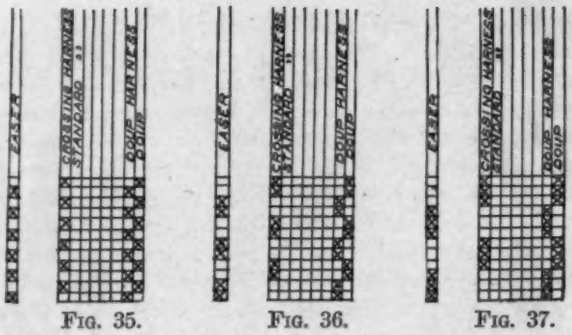


FIG. 35. FIG. 36. FIG. 37.

FIGS. 35, 36 and 37. CHAIN DRAFTS FOR DOUBLE ACTION DOBBY, FOR HEMSTITCH LENOS.

with the top knife in its outward position. The peg in the chain causes the harness lever A in Fig. 32 to raise the yoke to a position as illustrated in Fig. 33. Now, as the top knife is coming in and lowering the harness lever A and consequently lowering the yoke and doup, the bottom knife is passing out and a peg in the chain causes the harness lever B to come in contact with the yoke and raise both the doup harness and the doup; and the harness lever A not being raised will be in a position indicated as in Fig. 34. Therefore when using the yoke it is important and absolutely necessary not to put in pegs to raise the doup on crossed picks.

The chain plan for A, B and C in Fig. 19, shown on page 608 October issue, when using a double action dobby will therefore be as given at Figs. 35, 36 and 37, the drafts showing six, three and two repeats respectively.

(To be Continued.)

THE WORLD'S COTTON SPINDLES.

Consul Joseph I. Brittain, of Prague, reports that the statistics of the number of cotton spindles in use in the entire world March 1, 1909, show 130,795,927 spindles, as against 125,097,583 in use at the same date of the preceding year. The number of machines in use in each country on March 1, 1909, and the number in use at the same time of the preceding year are shown in the following table:

Country	March, 1908	March, 1909
United States	27,000,000	27,846,000
Great Britain	51,976,650	53,471,897
Germany	9,592,855	9,881,321
France	7,006,428	6,750,000
Russia	6,800,000	7,829,210
Austria	3,777,044	4,162,295
Italy	3,800,000	4,000,000
Switzerland	1,492,170	1,403,012
Japan	1,540,000	1,695,879
Spain	1,800,000	1,853,000
Belgium	1,155,787	1,200,000
Portugal	378,016	450,000
Holland	386,220	417,214
Sweden	420,000	430,000
Norway	73,360	75,000
Denmark	76,000	77,644
India	5,300,000	5,756,020
Canada	795,000	855,293
Brazil and Mexico	1,727,700	2,552,142

The number of spindles in use by the different branches of the cotton spinners' union is estimated at 3,017,492.

KNITTING

A STUDY OF FLAT KNITTING MACHINES.

(Contributed exclusively to COTTON.)

BY H. K.

PART I.

Flat knitting machines in which latch needles are used, include all machines which may have one or more flat or inclined needle beds, the needle beds being cut in tricks or grooves for the reception of the needles. The knitting movements are given to the needles by cams contained in a traveling cam box.

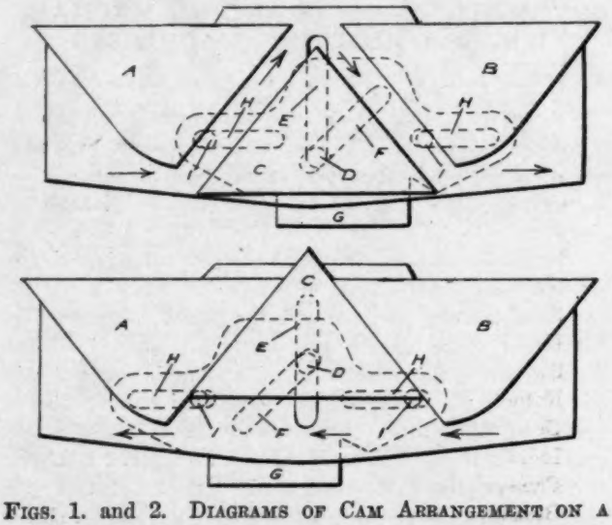
The various types of machines may be classed as follows:

1. Machines with one needle bed, which are used principally for gloves and the fancy trades; the fabric produced is known as "press-off" work.

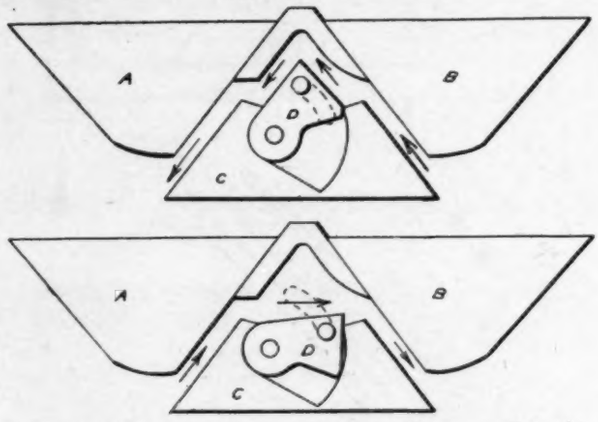
2. Machines which have two parallel needle beds, inclining obliquely towards each other at right angles.

3. Those machines having two parallel needle beds placed in a position that the needles can be actuated by cams on either bed. To accomplish this double-ended needles are used in conjunction with sliders or jacks.

Class 2 is the most important and is more widely used than the other types. They may be considered as the standard type of flat knitting machines. It is this type which takes the name of the inventor of flat knitting machines using latch needles—Lamb. In a flat machine of the Lamb type, the two rows of needles are placed opposite each other in grooves in a steel needle bed. The needle beds slope from each other like the roof of a house, and are separated at the top a sufficient distance to allow the fabric as knitted to pass down between. The needles move up and down the grooves to form the loops. They are held in the grooves by dovetail slides fitted into the beds. One of the needle beds is usually a fixture; either the front or back



FIGS. 1. and 2. DIAGRAMS OF CAM ARRANGEMENT ON A FLAT MACHINE, FOR PRODUCING THE PLAIN STITCH AND TUCK STITCH RESPECTIVELY.



FIGS. 3 and 4. DIAGRAMS OF ANOTHER FORM OF CAM ARRANGEMENT, SHOWING THE MOVABLE CAM IN ITS RAISED AND LOWERED POSITIONS.

may have a sideway movement by a lever at the left of the machine, this being to produce shogged ribs.

The front needle bed may be lowered to facilitate picking on new work on to the needles. The grooves in the needle beds are so placed that the needles when they rise to knit are between each other and when at their highest point the thread is laid between the two rows of needles. At the top of each needle bed and between the grooves are small projections, which serve the purpose of knocking over the old loops off the needles and they also divide or equalize the loops between each needle when working plain or rib, except I X I rib. The needles have two positions, namely: When in knitting position, and when not knitting. When not required to knit, the needles are moved down out of the range of the cams. The needles when in knitting position and within range of the cams, have a small spring at the bottom of each groove which prevents the needle from falling back out of knitting action.

The carriage consists of the cam-boxes, latch openers, and the yarn guide which may be attached to the center of the back cam-box and is adjustable so as to obtain the desired lead after each course. The carriage moves on two rails, one at the front and one on the back of the machine. The cam-boxes are two in number, one to each set of needles, each box containing the cams which give the rising and falling motion to the needles in order to knit. Each set of cams can be put in or out of action independent of the other. The simplest cam arrangement is that shown in Figs. 1 and 2. A and B are the knitting cams and are adjustable for the regulation of the stitch. This style of cam is known as the stop cam.

The center or raising cam C is shown in its bottom position in Fig. 1, and in its highest position in Fig. 2. This cam C has a pin D which projects into a vertical slot E in the piece holding the cams A and B, and also into a slanting slot F which is located in the horizontally movable piece G, the latter being limited in its horizontal movement by means of slots H and pins I. When the cam arrangement reaches one end of the needle bed on which it travels, the piece G comes in contact with a stop which shifts said piece G horizontally, causing the slanting slot

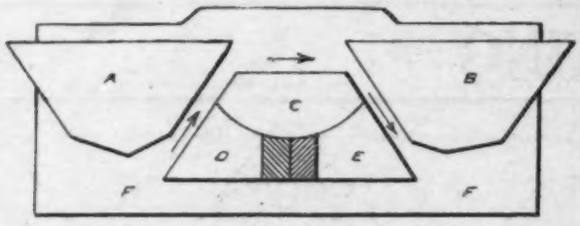
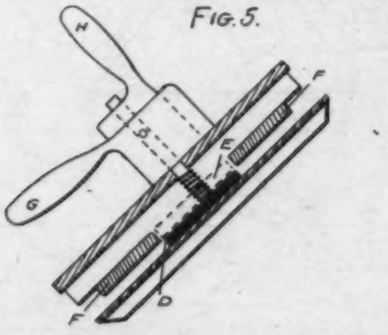


FIG. 5.



FIGS. 5 and 6. A THIRD FORM OF CAM ARRANGEMENT AND A CROSS SECTION, SHOWING OPERATING DEVICE FOR THE MOVABLE CAMS.

F to act upon the pin D to raise it in the vertical slot E, and hence the cam C is raised. At the other end of the needle, another stop is located to shift the piece G in the opposite direction which thus lowers the center cam C. Circular plain work, rib work, and open side work can be made with this type of cam.

To make cardigan or polka, royal or half-cardigan and the various "twills," shogged rib work, different motions must be given to the needles than those derived from the ordinary cams in Figs. 1 and 2. The chief difference in construction with regard to these machines lies in the style of cams used, and these vary greatly owing to the diversity of fabrics that can be made upon this the most versatile of all knitting machines. It will be understood that for different classes of work, different movements must be given to the needles, and hence the necessity for the different styles of cams. Figs. 3 and 4 show different positions of what is known as a cardigan cam. The center cam is composed of two members, namely, the fixed member C and the movable member D. The arrows in the two illustrations indicate the courses which the needles take as the came move over them. When the cam D is in its low position as shown in Fig. 3, the needles are only raised high enough to take the new thread without casting off the old loops. To avoid the same row of needles tucking at every course, the cam D projects a little above the cam C, so that on the return course after making one course in one direction the butts of the needles strike this projection and raise the cam D into the knitting position as shown in Fig. 4. When the cam D has passed the needles, it falls by gravity into its low position. This allows the cam to knit and tuck at alternate courses, producing a half-cardigan stitch, assuming that the back needles were knitting plain rib.

To knit full-cardigan both set of cams should be set to knit the tuck and plain stitches alternately. When the one set of needles is tucking, the other set should cast off two loops, this being done alternately on each set of needles.

Fig. 5 shows another type of cam arrangement. The wing cams A and B are the same as in Figs. 3 and 4. Besides these two cams there is a divided or split center cam which really a combination of a fixed cam C and two adjustable lifting cams is D and E. These two cams are entirely separate and can be moved inwardly and outwardly. In the outward position, they act upon the needles. By moving them outwardly they occupy a position whereby the needles are moved up to the cam C. When the cams are moved inwardly, they become embedded in the cam plate F and have no action on the needles. The cams D and E are not entirely flat but where they adjoin are beveled off to a knife edge. The method by which the cams D and E are raised and lowered can be seen in Fig. 6. The levers G and H raise and lower the cams D and E respectively. If one lever only be raised, one cam knits when going in one direction and does not knit when returning in the other.

According to the position in which the levers are placed, rib work, plain circular, flat selvaged work on either bed, or open side work may be made. Referring to Fig. 5 if the cam D were in its outward position and cam E inward knitting would only take place when the cam arrangement was moving in the direction opposite to the arrows, for on the return, the cam E being out of working position the needle butts will force the cam D into the cam-plate F, and will not rise to knit. The arrows indicate the path of the needles, and the cam arrangement travels in the opposite direction.

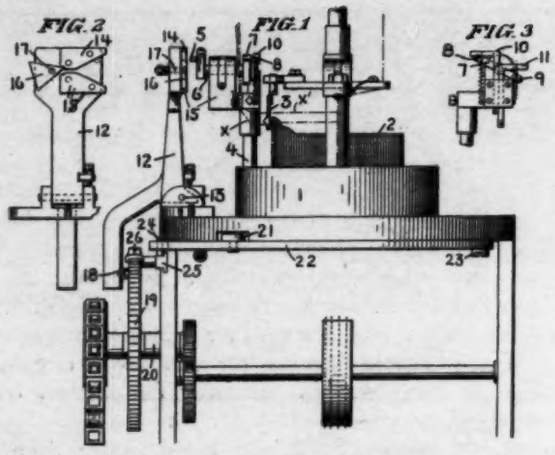
If ordinary rib work is wanted, the cams D and E would be lowered by means of levers G and H. For circular work cam D would be outward on one bed and cam E outward on the other; for plain work on single a bed both cams D and E are placed outwardly on one side and inwardly on the other. If tuck stitches are desired, the wing cams A and B must be raised so as to prevent the needles from knocking over the old loops, by raising A to its highest position by turning the pointer on the disk on the outside of the cam-box to 1. This cam arrangement would give a half-cardigan, assuming that the other cams are knitting plain rib. Full-cardigan will be produced if cam B was raised to its highest position, on the opposite cam-box.

(To be Continued.)

AUTOMATIC YARN CHANGING MECHANISM FOR KNITTING MACHINES.

The object of this device is to change from one thread to another in knitting a fabric, such as hosiery, in which mercerized cotton is employed in one portion and silk in another, with the least amount of waste or breakage of ends.

The device may be best explained by referring to the accompanying illustrations, of which Fig. 1 is a partial view of a knitting machine with the device attached; Fig. 2 is a view of the inner side of a spring controlled pivoted bracket, having a channel way and a movable cam which is shifted by a pin to throw one thread into action with the needles of the cylinder, and the other thread out of action with respect to the needles of the cylinder; Fig. 3 is a view of the mechanism for shifting a pin first into contact with one surface of the pivoted switch cam of the bracket shown in Fig. 1 to permit of the changing from one thread to another during the knitting operation.



VIEWS SHOWING THE DETAILS OF THE KNITTING MACHINE YARN CHANGING MECHANISM.

The device consists essentially of a thread carrying mechanism which revolves with the elyinder cam ring, and another mechanism located on the base of the knitting machine, the former being pivoted to operate inwardly and outwardly; and by means of a rachet and pawl and a pin, an inward motion is given to the upper part of the mechanism which comes into the path of the yarn guide arrangement as it revolves in the operation of knitting, causing it to operate and change the yarn being knitted into the fabric.

Referring to the illustrations, 1 indicates the cam ring which revolves about the needle cylinder 2. The special yarn guide is indicated at 3. The post 4 is fitted to the cylinder cam ring 1 and holds at its upper end the yarn changing mechanism, which consists chiefly in a pin 5 attached to one end of the shaft 6, the other end of said shaft being attached to the cross arm 7, the latter having a horizontal pin 8 extending from one end and a similar pin 9 at the other end. These two pins act to operate the bars 10 and 11 respectively which control the movements of the two yarns, to put them into and out of working position as required. It will thus be seen that a slight turn of the shaft 6 by having the pin 5 acted upon to partially revolve said shaft 6, through the mechanism just explained, the bars 10 and 11 will be moved in opposite directions, that is, putting one yarn X into operation and the other yarn X′ out of operation.

The arrangement for changing the yarn at predetermined intervals consists of an arm 12 pivoted at 13 and having at its upper end a groove made by the stationary cams 14 and 15 and the movable cam 16, which is pivoted at 17. When the upper end of the arm 12 is moved inwardly so that the pin 5 comes in contact with the cam 14, said cam will tend to press the pin downwardly which movement is continued by the cam 16 until the pin 5 passes the pivotal point of the cam 16. The action of the pin then causes the cam 16 to swing slightly on its pivot, so that the point comes in contact with the lower cam 15, making a groove which will cause the pin 5, when it again comes into contact with the cam, to be moved upwardly and thus change the yarns. The arm 12 is controlled in its operation by means of a pin 18 located on a rachet 19 which is loosely mounted on the shaft 20.

The rachet 19 is revolved slightly with every revolution of the cylinder cam ring 1 by means of a cam on the latter which comes into contact with the roller 21 pivoted to the lever 22 which in turn is pivoted at 23. The other end of the lever 22 carries the pin 24 which actuates a slide 25 to which is attached the pawl 26.

It will thus be seen that when the pin 18 comes in contact with the arm 12, the yarn changing mechanism will be operated. The frequency of the change is regulated by the number and positions of the pins 18 on the side of the rachet 19.

HOW THE AVERAGE CONDITION OF COTTON IS ASCERTAINED.

During the cotton growing season in this country the United States Department of Agriculture issues monthly bulletins on the average condition of the crop for the whole country. Owing to the different conditions of the cotton crop in the several cotton growing States and to the wide range of acreage planted, the average condition for the entire country is ascertained according to the following plan:

The condition of the cotton crop in the United States on September 25th was estimated as 65.9 per cent. of a normal. This figure was obtained by multiplying the average condition of each State by the State acreage, and dividing the sum of the products by the total area in the United States, as is shown in the following tabulation:

State	Thousands of acres	Condition Sept. 25	Product in hundreds
Virginia	34	78	27
North Carolina	1,477	72	1,063
South Carolina	2,601	70	1,821
Georgia	4,811	68	3,271
Florida	270	66	178
Alabama	3,641	67	2,439
Mississippi	3,312	63	2,087
Louisiana	1,089	51	555
Texas	10,504	63	6,618
Arkansas	2,446	68	1,663
Tennessee	777	73	567
Missouri	88	75	66
California	18	90	16
Oklahoma	2,128	70	1,490
United States	33,196		21,861

Dividing the sum of the products, 2,186,100 by 33,196 gives 65.9 for the weighted average of the United States.

Greece Cultivating Cotton.

An interesting and apparently successful experiment has been made in Thessaly in the cultivation of Egyptian cotton, with modern machinery and under the direction of an expert from Egypt. There are 35 cotton mills in Greece, equipped with 99,300 spindles and 1,211 looms, and representing a capital of $3,800,000. Employment is given to about 5,000 hands. The total annual product is valued at $2,088,000. Cotton is imported into Greece annually to the amount of 8,000 to 10,000 bales, as follows: American of good middling quality, 2,500 bales; Turkish, 5,000 to 7,000 bales; Egyptian, 500 bales.

Inquiries about anything pertaining to the textile industries will be cheerfully answered by COTTON.

DYEING, BLEACHING AND FINISHING.

HARMONY AND CONTRAST OF COLORS.

(Contributed exclusively to COTTON.)

BY DAVID PATERSON, F. R. S. E., F. C. S.

PART III.

In the last paragraph dealing with the contrast of colors, it was seen how one color influences another color next to it. Each color tinges its neighbor with its own complementary hue. But another modifying influence comes into play which is termed contrast of *tone*. A deep and dark color makes a lighter color next to it appear still lighter; while the light color tends to make the dark color appear still darker than it is, by way of contrast. This is seen in its simplest form by bringing together small patches of black and white on, say, a grey ground.

For example, take two small pieces of black paper cut like A in Fig. 1, and two similar pieces of white paper, and place them on a grey ground as shown in the illustration; A and B being the white pieces, and C and D the black, and A and D standing about an inch away from B and C respectively. On viewing them carefully it will be seen that the white piece marked B will *appear* to be whiter than the piece A, and also that the black C in contact with B will look darker than D. This is due to contrast of tone. The outlying pieces A and D will look in their normal tones, being surrounded on either side with the grey ground; whereas the two opposite B and C mutually contrast each other.

In every instance where a light tone of color is side by side with a darker one, we may observe this phenomenon of contrast of tone. Suppose we make a carefully gradated series of greys, on paper starting from the lightest wash of Indian ink, down to a dark grey; let every care be exercised to make the surfaces of each perfectly uniform and level, and each shade touching the other as shown in Fig. 2. On viewing such a series of what is often called "stepping shades," it will be observed that the light shade No. 1 at the left hand side appears a little lighter just at that point that it touches the darker shade No. 2. And that the step No. 2 looks darker just at that point where it touches step No. 1, and lighter where it joints with No. 3. Again No. 3 looks lighter when it reaches the darker step No. 4, but darker where it touches the lighter shade No. 2; and so on, throughout the whole scale. Therefore, in viewing such a series as we have made in Fig. 2, it does not look level and flat to the eye, but appears somewhat fluted or hollowed, resembling a series of waves. This is wholly due to contrast of tone. Wherever we have colored surfaces, differing considerably in depth or tone, placed side by side, the same effect is produced.

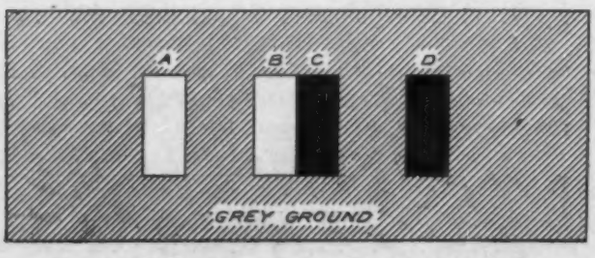


FIG. 1. DIAGRAM TO SHOW CONTRAST OF TONE.

This brings us now to the effect of simultaneous contrast of colors when placed on grounds of different luminosity. It is rather a difficult matter to illustrate an article on color contrast and harmony without having *colored* illustrations; but the reader will find it an excellent practice to color a few simple diagrams, (or cut them out of colored papers) as here described and study the different color appearances for himself.

Let three sheets of paper be taken—one white, the other grey and the other black—and then place upon these three grounds, at regular intervals as shown in Fig. 3, little disks of differently colored papers, as red, yellow, green, blue, purple and violet. Examine carefully the aspect of the colors and the effects the different grounds have on the appearance of the colors. The result found will be something like the following:

On the white ground, all colors appear deeper and darker.

On the grey ground, all colors appear normal and truest.

On the black ground, all colors look brighter and livelier.

I shall specify here a few examples and the student can extend them from his own observations:

ON A WHITE GROUND.

Red apears darker and more intense.
Yellow appears duller and not so lively.
Green appears deeper in tone and richer.
Blue appears darker and richer.
Purple appears darker and looks more like violet.
Violet appears deeper and more saturated.

ON A GREY GROUND.

Red appears brighter.
Yellow appears brighter and looks well.
Green appears brighter and livelier.
Blue appears clearer and saturated.
Purple appears clear and brighter.
Violet appears lighter and tends to purple.

ON A BLACK GROUND.

Red appears clear and luminous.
Yellow appears very brilliant and lighter.
Green appears brighter and paler.
Blue appears brighter and more luminous.
Purple appears a little brighter.
Violet appears more purplish.

To note such color changes as I have described is an excellent practice for the student of color phenomena, as it trains the eye in the appreciation of very fine differences in the tone and hue of a color. It also cultivates the valuable gift of careful observation.

AN EYE FOR COLOR.

The knowledge gained in regard to the changes in tone and hue that one color effects upon another near to it, will be of great service in every branch of industry where colored materials are employed, from the effective coloring of a carpet to the dressing of a shop window of colored stuffs, from the arranging of dyed patterns in a dyestuff advertisement book to the grouping of flowers in a flower bed. Indeed, in every instance where colors of any nature are employed, then the laws of contrast and harmony come into play. As I write there lies before me an advertisement card from a color manufacturing firm illustrating its

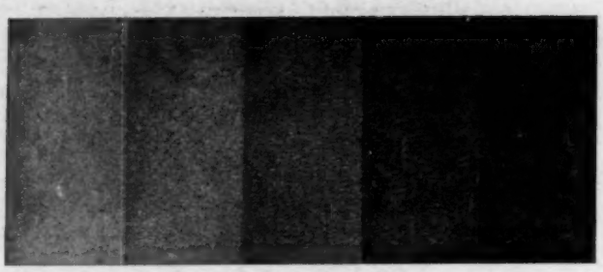


FIG. 2. SCALE OF GREYS, SHOWING CONTRAST OF TONE.

various dyes with pieces of dyed cloth arranged side by side.

But the colors are so arranged that in a few cases the adjoining color hurts its neighbor, and thus they are not shown to advantage. For example, a light clear tone of yellow is placed side by side with a strong, deep orange. The result is that the pale yellow looks paler and poorer beside the strong orange, and at the same time acquires a decided greenish tinge, due to its proximity to the orange. A green beside a blue-green, like turquoise, is rather a bad combination, likewise a yellow and a red together.

Where the colors are light, in the form of tints, or are shaded down with grey to form "broken shades," the unfortunate combinations are rendered not so objectionable, because the strong optical effect of the bright, strong color is greatly reduced when in the form of tints or shades of these colors. A great amount of care and forethought are often required to so arrange a selection of colors that, when placed side by side, they mutually enrich and help each other.

Some color writers have tried to propound a theory whereby proper color harmony is produced from definite and exact proportions of the three primary colors. But such theorizing is found to be quite impractical in every day work. One writer, for example, says that harmony in a color composition is insured by the presence of red in the proportion of three parts; of blue, eight parts; and yellow, five parts. But color harmony is not so mechanical or mathematical a matter as that. The finest harmonies that delight the eye cannot be made to conform to so simple a rule of proportions, although the principles of harmony can be clearly laid down and explained, as in our former pages. For example, we have already seen how certain colors, such as yellow and green, or red and purple in a fabric do not give pleasing results, whereas yellow and blue or violet, or red and green do give harmonious effects.

What is often termed "an eye for color" is a natural endowment like the gift for music or painting; although a great deal can be done in educating the eye to the appreciation of color and its harmonies. The student should take every opportunity of studying systematically all high-class works of art done by capable colorists, whether they be in dyed or printed textiles, paintings, stained glass, pottery or enamels, mosaics, wall papers, etc.,—anything, indeed, where color comes into play. By making a practice of mentally analyzing the color schemes in all such objects of art the student will, after due perseverance, acquire facility in combining colors to their best effect. It is an excellent practice.

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*From David Paterson's "The Science of Color Mixing."

COLOR CONSTANTS.

When we critically examine any color we will always find there are three inseparable qualities connected with it, namely, (1) its hue; (2) its purity; and (3) its brightness or luminosity. These three characteristics of all colors go by the name of the "constants." Let us describe them briefly.

1. When we look at a color, the first thing that catches the eye is its own distinctive color or hue. We call it a red, or a blue, a green or a violet, as the case may be. In speaking about colors the terms "shade" or "tint" are often wrongly used when hue is meant. For example, a blue may have a proportion of red in it to make it tend towards a violet. This, then, is correctly described as a blue of a violet hue, and not a blue of a violet shade or tint as so often described. The term "shade," as will be mentioned later, is correctly reserved only for those colors darkened or shaded with black or grey; while a "tint" is a color reduced with white. The hue is always the predominating color in a color. If we mix red and blue together we get a purple; but if the red predominates it forms a purple of a red hue; while, if the blue predominates over the red, we get a violet, or a purple of a blue hue. This then—the HUE is the first constant of a color.

2. On a closer inspection of the color we find that the hue is not as rich and saturated as it might be, when compared with the standard color of the spectrum, but contains a proportion of white light. It is not pure. It may contain much or little white light according to its purity. Colorists have agreed to confine the term PURITY, to the absence of white light reflected from a color. This is the second constant. It often goes by the term "chroma," especially by American colorists. For example, the color of a carpet or a rug is said to lose chroma when it fades on exposure to sunlight. It becomes weaker and fainter.

But it often happens that when a color fades it also changes its hue as well. A yellow, for example, may not

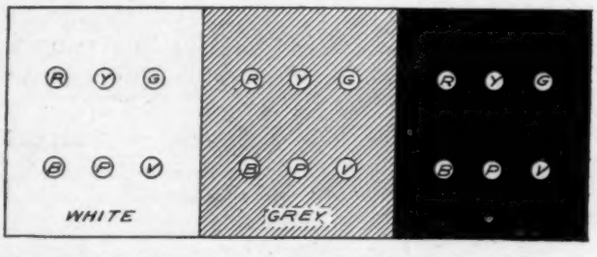

FIG. 3. THE EFFECT OF DIFFERENT GROUNDS ON COLORS. CONTRAST OF TONE.

only become fainter or whiter on exposure, but also redder; and a blue may tend to become greener, or more violet, as well as fainter; so in these cases we have change in purity or chroma, and also in hue.

3. The third color constant is its brightness or luminosity; that is the total amount of light it reflects to the eye. Professor O. N. Rood has shown that the luminosity of color can sometimes be accurately measured by means of the rotating disk. The photometer also gives us a good means of measuring this color constant.

Considering the luminosity of white paper to be 100. Rood has found that the luminosity of pale chrome yellow is 80.3; pale emerald green is 48.6; cobalt blue is 35.4; vermilion is 25.7; ultramarine is 7.6. Every color in the spectrum has been examined, and it was found that they

stand in the following order of luminosity. (1) orange yellow, most luminous; (2) yellow-green; (3) orange-red; (4) red and blue-green, equal; (5) red and blue (equal); (6) dark red; (7) blue-violet; (8) violet (least luminous).

COLOR TERMS.

Before we proceed further in our study of color harmony it might be well to impress upon the student the necessity of being careful in using the exact and proper color terms, because considerable misunderstanding sometimes arises from the indefinite way in which they are used. It is common to hear in ordinary conversation of a yellow or a green having a "bright shade"; or of "deepening a color into a tint." Both are wrong uses of these terms.

TINT.

The term "tint" is used only where a color is reduced with white, to make a lighter color. If white be added to orange red it forms a salmon buff tint; or if white be added to violet, it produces an amethyst color, which is a "tint" of violet. Pink is a tint of crimson; and lavender a tint of bluish purple. By the addition of regular increments of white a series of gradating tones or tints is obtained; or what is more correctly termed a "reduced scale."

SHADE.

The term shade is now correctly reserved to a normal color which is darkened down with black. Regular additions of black produce a "darkened scale" of that color. By adding a little black to scarlet we get a brown "shade"; and black added to red produces a maroon "shade," black added to violet makes a purply slate shade, and so on. It is not correct to speak of a yellow of a greenish hue or cast, as one of a greenish "shade." Hue is the proper word in all such cases.

BROKEN TINTS.

By adding increasing increments of grey to the normal colors we get a dulled scale, or what are termed "broken tints," which are simply greys having a certain distinctive hue.

The term "tone" includes all these three different scales, that is, reduced with white, darkened with black, and dulled with grey. So that it is quite correct to speak of a reduced scale of red purple as tones of heliotrope; or a darkened scale of red, as tones of maroon or plum; and a dulled scale of green as tones of sage, and so on. All the many fashionable art or "mode" shades of the present day which absolutely defy definite description, are simply broken tints, or grys, having a certain hue predominating over the neutral grey. For example, russet is a grey orange red; terra cotta is a grey orange; old gold is a grey orange yellow; citrine is a grey yellow; sage is a grey green; slate is a grey blue; and claret is a grey crimson.

It is an interesting fact to remember that when complementary colors are reduced, or broken or shaded, they are still complementary to each other. Indeed the most harmonious color combinations are those where dulled colors are employed. Pure normal complementary hues are most difficult to handle properly. They give harsh and glaring contrasts, harmonious no doubt, but strong; so that tints and dull tones and shades are the best to use and safest. The very fact of them being reduced and softened enables them to be used with freedom, with less fear of a harsh and inharmonious result. The bright and strong normal hues must be used sparingly and then only with caution.

COMPLEMENTARY "MODE" SHADES.

For the convenience of the colorist I append here a few complementary tints and shades* which will aid him in producing an harmoniously colored result when used in any textile fabric.

Buff and pea green; pink and straw color.

Heliotrope and lemon; lavender and cream tint.

Azure and amber tint; pale blue and salmon.

Pale turquoise and salmon buff; sea green and yellowish pink.

Brown and sage green; red brown and dull indigo.

Russet and slatey plum; citrine and slatey blue.

Myrtle green and brown red; olive and claret.

(To be continued.)

THE PURIFICATION OF WASTE WATERS FROM DYEHOUSES AND BLEACHERIES.

BY FREDERIC DANNERTH, CONSULTING CHEMICAL ENGINEER.

Although a large fraction of our population is dependent on rivers and creeks for its drinking water supply, it is curious to note that a very small number of our manufacturing plants pay even the slightest attention to the disposal of their effluent, chemical laden and murky waters. Aside from the sanitary point of view let us consider for a moment the fact that there are other manufacturers lower down the stream which probably receive their water supply from the same river which the more favored neighbor has used as a sewer.

The waste liquors from scouring plants, dyeworks and bleacheries belong to the class of most objectionable effluents, for they are highly colored, contain chlorine, hold in suspension large quantities of foreign matter (one to two parts per 1,000) and have a nauseating odor. As a typical instance in which a national waterway is used as a municipal sewer we might cite the Passaic River, in New Jersey. This is a sluggish stream with a turbid, almost inkish appearance which drains a strongly developed manufacturing district. This river, the bed of which is impregnated with decomposing organic matter and which is continuously giving off noxious gases is an eyesore and an unquestioned detriment to the health of the community. Such a state of drainage can be remedied only by the individual effort of the manufacturers and this in turn must be stimulated by State legislation.

The simplest form of clarification plant consists of two reservoirs from 25 to 50 feet in diameter and from 10 to 20 feet deep. While reservoir No. 1 is settling, reservoir No. 2 can be filled, and during the time in which No. 2 is settling the first reservoir can be drained off. In any such system it is desirable to allow different varieties of effluent to meet in one tank so that they may interact and thus mutually precipitate each other. When the amount of water to be treated is very large and the time is limited, the first reservoir is not given a chance to settle, but the mixed liquor is allowed to drain through filter beds of coke, gravel and sand. The best results are obtained by adding to the mixed liquor various chemicals which act on the acids, dyes, mordants, soaps, albuminous matter, tannins and dissolved inorganic salts. In this case the liquors are first run into tank No. 1 where the suspended matter and the products of the first interaction are allowed to settle while the addition of chemicals takes place in tank No. 2.

Shortly after the addition of chemicals and suitable agitation, the mixture is pumped into large basins where sedimentation takes place. The water resulting from this treatment is perfectly clear and is not detrimental to animal life in the river. In certain cases the solid matter which settles in reservoir No. 1 is so voluminous that it may be dried and used for the manufacture of gas. The chief advantage which this application of sludge lacks is the regular supply. In bleacheries the waste waters contain alkalies, acids, soap and bleaching powder so that mutual purification can be very readily effected. In wool dyehouses the effluents contain wool fibers, dyes, soaps, tannins, and mordants so that in this case the treatment becomes somewhat more complicated. In preparing a lay-out for a clarification bed, the first point to be noted is the volume of effluent to be treated. Thus, for example, a woolen weave mill with 100 broad looms will require about 65,000 gallons of water daily for scouring and finishing. It is interesting to note that solutions of bleaching powder (calcium hypochlorite) are now being used to a large extent in the purification of household sewage so that the waste waters of bleacheries may after all be of considerable value as an effluent in large cities. When bleaching powder is systematically added to sewage a 0.5 per cent. solution is prepared and this is added at such a rate that the treated sewage contains about one part per 800,000 or even as much as one part per 600,000 parts of sewage. Among the factors which must be taken into consideration in the planning of clarification beds are:

(1) The general composition of the waste water; (2) the volume of waste water to be treated in 24 hours; (3) the percentage of solids in the waste water; (4) the degree of purification required by the municipal authorities; (5) the ground area available for the works; (6) the character of the soil; (7) the amount of drop from the "inflow" to the level of the sewer; and (8) the character of the sludge obtained by sedimentation or filtration. This last factor will determine the methods to be used for the disposal of the solids contained in the waste water. These disposal methods are: (a) Conversion into marketable manure; (b) deposition at sea; (c) shallow burial in the ground; and (d) air drying and conversion into gas.

In one large woolen mill the waters from the scouring of raw wool, yarn and piece goods are pumped into a reservoir. From here they pass through a sieve into a settling tank where the mixture is allowed to settle for five hours. From here it is pumped to elevated "magma" tanks, which are rectangular, five in number and hold 5,000 gallons each. These magma tanks serve as "agitators" in which the water is mixed with a calculated volume of sulphuric acid by means of compressed air. After sedimentation has taken place the supernatent acid liquor is drawn off into a collecting tank while the sludge which has settled to the bottom of the tanks is drained off into a sludge pit. This latter is constructed with a drain bottom consisting of porous material so that the liquid will seep through the bottom into the collecting tank. The pasty sludge which collects on the bed of the sludge pit is removed and sold as a source of oil and fat.

The colored effluent from the dyehouse is sieved in a manner similar to that described for the scouring liquors. It is allowed to settle and is then pumped to elevated coagulating tanks. In a separate tank a "milk of lime" is prepared with two ounces of lime per gallon. The next step is to pump into the coagulating tank a suitable quantity of the milk of lime and at the same time the liquor from the collecting tank is pumped into the coagulating tanks. Here the coloring matters are thrown in flocks which readily settle to the bottom. The colorless supernatent water may now be run directly into the river or it may be mixed with acid rinsing waters from the dyehouse. The sludge which collects at the bottom of the coagulating tank is drained off and allowed to percolate through a bed in a special pit similar to that sludge pit mentioned above. By this treatment it was possible to reduce the total solids to 0.5 parts per 1,000 and the effluent contained no salts but those usually found in river water (with the exception of 6/1000 gram of bichromate of potash which could not be removed from the mordant waters.) The clarification process just described is based chiefly upon mutual purification and the elimination of the sludge before the effluent is returned to the river.—Textile Manufacturers Journal.

Practical Problems Discussed by Cotton's Readers.

Discussions of Mill Problems are Solicited for this Department.

WASTE IN COTTON MILLS.

BY MANAGER.

In my last article, I mentioned that Mr. Edmondson's test of waste from pickers was interesting, but the loss in waste was too small, and that I would give your readers some tests I made some years ago. In your issue of February "C. C." goes into this matter a little deeper than did Mr. Edmondson, and the following tests of mine will show that I went into it still further than either of these gentlemen. To my mind neither of these gentlemen went into it as thoroughly as they might, or as they ought, in order to give your readers the correct average losses through the several picker beaters, as well as all other losses. "C. C." took only about 100 pounds of cotton. He does not say if he took it all from one bale, or a little from several. If he took the cottons from one bale, each test, the difference in per cent. of waste can be accounted for, as we all would expect S. G. Middling to make less waste than Middling. 6.21% to 5.53% in favor of middling cotton in this case. I say this can be accounted for, because no matter where you take the cotton from in a single bale, it does not represent the average of that bale, unless you are careful to take a few pounds here and there throughout the bales. Mr. Edmondson's test is more satisfactory than C. C.'s, because he took about 100 pounds from each of ten bales, which gave him about 1,000 pounds to start with. I do not undertake to tell where Mr. Edmondson made an error, but an error there must be, for there is no cotton grown that will only give 2.7% waste in picker. But I am going to assume Mr. Edmondson is correct, for he says he used 1015.5 pounds of cotton and got 988 pounds in laps, equals 2.7% loss. But did you not weigh your lap sticks, Mr. Edmondson, in order to get the 988 pounds laps? I offer this as a suggestion, not as a fact, as your hand who weighed these laps might have included the lap stick, which with them would bring the per cent. of waste about where it should be; still

less than it ought to be. I am going to show the difference between new cotton and old cotton, so-called. With the new cotton, the test was made as soon as we got it from the South, from the new crop in October, and then again from this same lot of cotton in January following. The cotton in both cases was what we called Alabama upland cotton, which we consider a little longer staple than Georgia uplands.

To make this test as thorough and perfect as possible, I had the picker room cleaned out from top to bottom, the walls and ceilings swept clean, the dust room cleaned as perfectly as possible. Every part of the pickers cleaned inside and out, so at time of my inspection before starting test I doubt if one-half pound of any dirt could be found in or about the pickers or rooms. Thus we got a good starting point, clean room and machines. Now I had thirty bales of Alabama upland, strict middling cotton taken into the room, weighed carefully, opened, and well mixed, the sacks well cleaned, weighed, along with the hoops, and these laid to one side in the picker room until the test was completed. I had the picking machinery cleaned every day during the run of this thirty bales, as under ordinary running conditions, weighing carefully the waste from each beater, and sweepings each day, and a record made of same. When the thirty bales was run up, the machinery and room, including dust room were gone over just the same as before starting the test. All waste from the carding and spinning departments was excluded from the picker room while this test was going on.

This test was made in October, 1878, and of course the machinery was a little different from what is now used. There was an opener, called at that time a compound opener and lapper with three beaters, the first beater being the swivel, 36-inch diameter when in use, all other beaters being the ridged, making six beaters that the cotton went through. The cotton was spread on by hand, and doubled three on finisher picker. The thirty bales weighed gross 15,294 pounds. We were four days in running it up, and the weather was clear, mild October days. We got 13,656 pounds of laps without sticks. We collected from

First Beater or Breaker Picker.....	104	lbs.
Second Beater or Breaker Picker.....	89.5	lbs.
Third Beater or Breaker Picker.....	62	lbs.
First Beater or Finisher Picker.....	63	lbs.
Second Beater or Finisher Picker.....	38.5	lbs.
Third Beater or Finisher Picker.....	33	lbs.
Total.....	390	lbs.
Sweepings ..... 49.5 lbs.		
Dust Room ..... 278 lbs.		
Hoops and Sacks ..... 660 lbs.		
	987.5	lbs.
Total.....	1377.5	lbs.
Unaccounted for	260.5	lbs.
Gross Loss—Total	1638	lbs.
Picker Waste	2.55%	
Sweepings and Dust Room.....	2.14%	
Hoops and Sacks.....	4.32%	
Unaccounted for	1.70%	
Total.....	10.71%	

I do not see any better way, or one more correct, to get at the loss in picker than to take into account all the loss as picker waste, except the hoops and sacks. Then we have a gross loss of 6.39% called picker waste. Mr. Edmondson perhaps only weighed the waste from under the beaters in his test, or not at all, then 2.70% as he states would not be far away. But it does not convey the whole loss, or only a fraction of it, and the beginner would wonder where the loss comes in, when 15% loss in waste from the whole mill, is about what all managers allow in order to be on the safe side. As I make the loss in picker alone 10.71% this allows only about 4% for the balance of the mill, and it ought to cover such loss, making the usual allowance for sizings on yarns woven, and finishing. I know some mills figure more than this, and some less, but we think those who figure less are mistaken, very often.

Now to the next test on the same cotton three months later, in January, 1879. Without going into the figures in detail, I say on this date, going through just the same test, being just as particular to have all places clean as before, we found we took out 11.56% waste, as before. Then I tried this same test the next two years, in October and January, as before, and the results were as follows:

October, 1879, it was.....	10.26%
January, 1880, it was.....	11.18%
October, 1880, it was.....	10.86%
January, 1881, it was.....	11.72%

I have never tried it since those dates, but they gave me a most valuable data to base future calculations on, and I find them to be as correct as anyone might wish.

I want to comment a little on the table of tests "C. C." has in February number. Strict good middling cotton he made the picker waste 6.21%, while the middling cotton he made only 5.53%. He says the strict good middling staple was 1 inch, while the middling was only 7/8-inch staple. Now it has always been thought that the shorter the staple more picker waste, as well as more card waste. In both cases "C. C." makes the mid cotton show better except in the breaking strength, and even there it is not much under strict good middling cotton, but way below good middling and strict middling, and not as good as strict low middling. There is a great difference between these tests, and not a very good basis to figure "economics" for the mill, as it would puzzle the experts to select the cotton for their mill, if they were to go by this test. But in summing up my comments on this would say, that but very little good ground can be found to work on in the cotton selection, by only using a few pounds of any grade, to form a basis for future selections to run in your mill. If "C. C." would take ten or twenty bales of each of the grades he did in his test he gives, and push them through the mill, in the usual form, keeping close tab on its progress at each and every stage, into yarn, he would have something more correct or satisfactory, I should say, for himself as well as his readers. I know it is a bother and quite a lot of care to make the tests I have given above, as well as to carry it further along in the mill, but it pays to do it, and the overseer of carding who is so busy that he cannot spend at least one full week twice a year in testing out a lot of cotton is to be commiserated indeed. But to any and all who have never gone through these tests I would say, "Try it," and if you do not find it pays and gives you such satisfaction that you never had before, then I shall be mistaken in the stuff that is in you. Try it, and do it well and thoroughly; no half-way work about it.

BOILER AND ENGINE ROOM NOTES.

BY H. G. SMITH.

In the earlier days of cotton manufacturing the one main object was production. Get production was the constant cry and very little attention was paid to cost analysis. Now, however, with the margin of profit so narrow it is necessary to keep careful watch on every process and prevent or stop every little leak before it either becomes a large one itself or combines with other small ones to do so.

It is my purpose to discuss only the steam plant here as that allows more chance for waste than electric power bought from some outside line or than the development of water power. At the outset in the location of a cotton mill the facilities for handling its fuel should be carefully considered, as the cost of transportation of coal very often exceeds the price of the coal itself. The writer knows of several plants where the coal cars are placed on the mill's chutes by the railroad companies, within a few feet of the boiler room, necessitating the handling of the coal only once. Small tracks can be laid in front of the furnaces and thence on out to the chute.

A pair of scales should be a part of this track and every bit of coal used should be weighed and recorded. Each day's run should stand to itself with notes on any extras or irregularities. It will be found though that the weights thus kept will seldom ever amount to as much as the car weights.

Naturally it will require more of some kinds of coal than others, and just here is where one is often misled as to "cheap coal" which in the end is not anything of the kind.

A coal analysis should be made or should be required, giving the per cent. of moisture, volatile matter, fixed carbon, ash, and B. T. U. per pound of the coal in three states, namely: As received, dry, and combustible. Then we know what we are getting and what to expect. If the coal is found to be of a good quality, look somewhere else for the waste.

See that an even fire is maintained all the time, that the grate bars are kept cleaned and that the draft is kept open. Look at the ash frequently and be sure that you are getting a thorough combustion. Next see if there is not some loss of steam by radiation. Some pipes carrying live steam that need a covering of asbestos, or some places exposed to drafts of cold air. Keep all the little leaks down, for many of them will certainly amount to a nice amount. Whenever the saving will warrant it put in steam traps, use all the waste and exhaust steam to heat the feed-water. A regular feed-water heater or an economizer which uses the smoke and its accompanying gases to heat the feed-water will be found to effect quite a saving.

Having stopped the leaks in the boiler room, go to the engine room and see what your engine is doing. Indicate it, and if it is a compound engine, indicate both the high pressure and low pressure sides at the same time. Then study the cards carefully to see if there is not some improvement which can be made. Be sure that the eccentric is at the right place, and that the admission, the cut-off and the exhaust are set just as they should be. Make the absolute pressure at the point of cut-off as high as possible and at the point of release or the back pressure as low as the engine will stand. Ascertain the temperature of the condensing water, both cold and hot and improve on it, if possible, getting the vacuum up as high as you can.

If the operation of the plant seems to warrant it, and the engineer is capable of doing it, a complete boiler and engine test should be made.

PRODUCTION AND SPEEDS IN THE SPINNING ROOM.

BY F. S. T.

On January 1, 1910 the running time of the cotton mills in the State of Massachusetts was reduced from 58 hours per week to 56, yet the same amount of production was desired in the 56 hours as was previously obtained in the 58, and the only way to obtain it was to speed up the frames. The frames previously produced about 140 pounds per spindle per week of No. 30 yarn with 6¼-inch traverse 1¾-inch ring, with a spindle speed of about 10,000. The frames ran very well, spinners running from 6 to 8 sides of 120 spindles each doing their own cleaning and oiling and winding off, *not cutting off* their piecings.

When the extra speed was applied, we found that it was almost impossible to keep the bobbins from rising on the spindles and causing excessive waste at the frames and spoolers, also a poorer quality of yarn. The first thought was that the spindles vibrated too much, but upon inspection they were found to run very steadily. Bobbins were then taken from the spindles where they showed no tendency to rise and were placed upon those where the tendency was to rise and vice versa. We found that almost all of the bobbins that had a tendency to rise on the first set of spindles showed that tendency on the spindles where the other bobbins had run steadily; and those bobbins that had run steadily on the first set of spindles also ran steadily on those spindles where the other bobbins had risen, thus proving that the fault was in the bobbins.

The next thing was to carefully inspect the bobbins and we found that out of 10,000 bobbins over 3,000 of them would rise on the spindles the other 7,000 running all right and allowing us to run the necessary speed and still get the quantity and quality that we did before. Now the question arose if it would not be best to try every lot of bobbins at the highest spindle speed and all those that showed a tendency to rise condemn and ship back, but the percentage being so large, doubt was expressed whether any bobbin maker would accept our trade at the regular price if we were so particular in regard to our bobbins, so from the experience that we have had in our mill I should say that the speed of our modern frames is not limited by the speed of the spindles, or the quality of the rings or travelers but by the quality of the bobbins.

The frame, the ring, the spindle and the traveler man have met every demand placed upon him for speed, but the bobbin man is behind. Therefore before the speed of our frames can be increased much more we must demand a better bobbin from the bobbin manufacturer and he must go into this problem as deeply and as systematically as has the frame, ring, spindle and traveler man. When he catches up we can perhaps go ahead a little further in regard to speed and production until we reach the limit. But who will state where that limit is? At present it seems to be at about 135 revolutions per minute of the front roll on No. 30 warp yarn, but will we be content to stay there? Surely not if our bobbins will run steadily on the spindles, it will then be up to the spindle, or the ring, or the traveler man or whoever is behind.

NEW MACHINERY AND TRADE NOTES.

A NEW MOTOR DRIVEN QUILL WINDER.

The 40-spindle quill winder shown by the accompanying illustration is the first motor driven machine of its type made by the Oswald Lever Co., Philadelphia, Pa. The motor is securely fastened to the machine frame. The driving connection is through single gear reduction to the shaft of the winder. This application marks another step in the adaption of electric motors to the silk industry and will unquestionably again demonstrate the inherent advantages of individual drive.

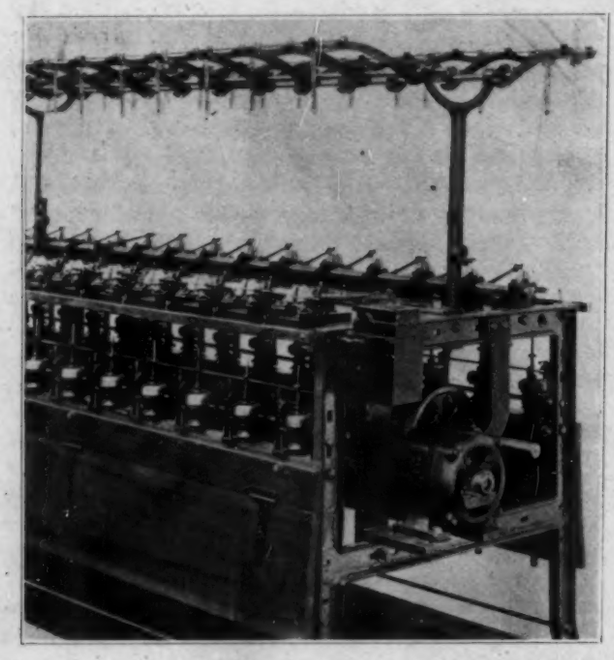

FIG. 1. AN OSWALD LEVER COS. QUILL WINDER DRIVEN BY A WESTINGHOUSE MOTOR.

The motor is specially designed for textile service and is designated as "textile type." It has dust proof bearings and a dust proof rotor; that is, no ventilating ducts are provided. In spite of the absence of all rotor ventilation, however, the distribution of material is such that the motor operates exceedingly cool. It is rated at ½ horsepower, 1,140 R. P. M. for use on a 3-phase, 60-cycle, 220-volt circuit. Being of the squirrel cage induction type, the motor has no commutator, collector rings, or other exposed current carrying parts. The equipment includes an enclosed "textile type" switch, which is operated by means of the shipper handle, thus placing its control within easy reach of the operator from any part of the machine. Both motor and switch are made by the Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

GRINNELL WILLIS & Co., New York City, dry goods commission merchants have made the following advanced prices on Wamsutta 4/4 bleached goods: OXX, 4/4 Wamsutta, 12½c; OX/B, 4/4 brown Wamsutta, 12¼c; 4/4 Wamsutta Jeans, 12½c; 4/4 Wamsutta Nightrobes, 14c; 4/4 Wamsutta ICT, 14c; 4/4 Wamsutta Percale, 13½c; 36-inch Wamsutta Cambric, 10¾c; 36-inch Wamsutta Longcloth, 10¾c; 36-inch Wamsutta Nainsook, 10¾c.

THE HYGROSSO HUMIDIFIER IN THE SOUTH.

Among the best known young men in the South to the cotton mill industry is John M. Schott, Southern representative of the Hygrosso Humidifier invented by Jno. W. Fries, Winston-Salem, N. C. and New York. Hygrosso Humidifiers have been on the market a little over eighteen months. During that time, approximately 700 machines have been installed and are running satisfactorily. They are made in three types: Belt driven, direct current motor driven, and alternating current motor driven. They are suitable for use in knitting mills, woolen mills, cotton mills and, in fact, in any kind of industry where an accurate percentage of relative humidity is required. All of these machines are equipped with an "automatic control" on every head. They are claimed to be more simple in mechanism, more economical to run and maintain, more durable in their construction, and take care of a greater amount of air space than any head now on the market. In addition to this, it is said to be the only machine with individual regulators on each head.

Some of the recent sales in the South are the Fulton Bag & Cotton Co., Atlanta, Ga., Neely Cotton Mills, Yorkville, S. C., Wymojo Cotton Mills, Rock Hill, S. C., Manet-

JOHN M. SCHOTT, SOUTHERN REPRESENTATIVE OF THE HYGROSSO HUMIDIFIER.

ta Mills, Lando, S. C., Brown Mfg. Co., Concord, N. C. and Cornelius Cotton Mills, Cornelius, N. C. In addition to this, there have been sales in the North. Jno. E. Schott has been with John W. Fries for ten years, first as an erector of dyeing machinery and later as a salesman for the same, and now as Southern representative for Hygrosso Humidifiers and dyeing machinery, the patents on which are owned solely by John W. Fries.